

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF NEW MEXICO**

UNITED STATES OF AMERICA,

Plaintiff,

vs.

Cr. No. 10-2734 JCH

JOHN CHARLES McCLUSKEY,

Defendant.

MEMORANDUM OPINION AND ORDER

This matter is before the Court on Defendant's *Motion To Exclude DNA and Serology Test Results and Request for Daubert Hearing*. [Doc. No. 422, filed April 22, 2012; Doc. No. 442 (Defendant's (*Corrected*) *Supplemental Memorandum*), filed May 10, 2012]. Defendant, on numerous grounds, asks the Court to hold a *Daubert* hearing and to exclude the Government's DNA test results. The Government filed a Response [Doc. No. 547, filed June 25, 2012], and Defendant filed a Reply [Doc. No. 562, filed July 9, 2012]. Both parties also filed voluminous exhibits on CDs submitted to the Court.¹ [May 14, 2012; June 25, 2012]

The Government argued that a pretrial *Daubert* hearing was unnecessary. [Doc. No. 547, pp. 57-58] The Court agrees that a pretrial *Daubert* hearing is not warranted on most issues, because a sufficient record has already been presented in the hundreds of pages of briefs and thousands of pages of exhibits. On May 6 and 7, 2013, however, the Court held an evidentiary

¹ Defendant submitted 33 exhibits numbered 1 to 33 on CD (May 11, 2012). Defendant renumbered these 33 exhibits and helpfully submitted hard copies of them along with additional exhibits at the May 6-7, 2013 evidentiary hearing. The Court refers to Defendant's exhibits by the designations given to the hard copies admitted, G6 to E10.

The Government submitted 37 exhibits numbered 1 to 37 on CD (June 25, 2012). The Government then submitted hard copies of 36 exhibits, numbered 1 to 36, at the May 6-7, 2013 evidentiary hearing. To distinguish between these identically numbered exhibits, the Court adds the date after the exhibit number—i.e., either "(6/25/12)" or "(5/6/13)."

hearing on the admissibility of Low Copy Number (LCN) testing; Defendant was present at the hearing. At that hearing the Court admitted about 100 additional exhibits, for a total of about 3,500 pages of exhibits.

The Court has reviewed the parties' filings, the evidence presented, and the relevant law. The Court grants Defendant's motion to exclude the results of LCN DNA testing; the Court otherwise denies Defendant's motion to exclude DNA evidence. The Court concludes that the Government has not carried its burden of demonstrating, by a preponderance of the evidence, that the results of the LCN testing conducted by the New Mexico Department of Public Safety (NMDPS) Laboratory are admissible. The Court thus specifically excludes the DNA evidence on Item 1B23B, conceded by the Government to be an LCN result. With respect to the remainder of Defendant's arguments, the Court concludes that Defendant's motion is not well taken and is denied.

BACKGROUND

Several handguns were collected when Tracy Province, and later Defendant and Casslyn Welch, were arrested. Numerous swabs were taken from the Haases' pickup truck and from items inside the truck. These items and others were tested by Carrie Zais Davis, the Government's DNA analyst at NMDPS Laboratory.² Davis produced a number of reports setting forth her test results, her analyses, and her opinions. These lab reports were provided to Defendant, and Defendant provided them to the Court. [Def's Ex. G6]

The Court has four lab reports, from August 30, 2010; September 30, 2010; December 22, 2010; and April 27, 2011. These lab reports list the numerous items examined, the procedures employed, the analyst's results and conclusions, and in some instances the statistical

² The reports and curriculum vitae initially referred to the Government's DNA analyst as "Carrie Zais"; by the time of the May 2013 evidentiary hearing, her name is "Carrie Zais Davis." The Court generally refers to her as "Davis."

analysis. The Government proposes to have its DNA analyst, Davis, testify at trial to her results and conclusions from DNA testing. According to the Government's disclosure, Davis is also expected to testify regarding collection of samples, the strict chain of custody observed, lab controls in place to protect the integrity of the samples, and the peer review process used in the analysis of these samples and subsequent comparison. [Doc. No. 442, p. 19]

For instance, the Government asserts that a .40 caliber Smith & Wesson handgun was the murder weapon. [Doc. No. 547, p. 4] Davis tested and analyzed a number of swabs taken from different parts of this handgun, Item 1B22. Davis's lab report states the procedures and methods used: "the Applied Biosystems AmpF1STR Identifiler PCR Amplification Kit on a GeneAmp PCR System 9700 thermal cycler," an "Applied Biosystems 3130 Genetic Analyzer," and "GeneMapper ID software." [Def's Ex. G6, Sept. 30, 2010 report, p. 2] Davis's report states that a DNA mixture was obtained from different parts of this handgun and magazine, and states her opinion: "To a reasonable degree of scientific certainty, John McCluskey is the source of the major DNA profile resolved from these mixtures." [*Id.* (referring to Items 1B22A (swab of stains on rear of handgun slide); 1B22B (swab of stain on inside of handgun ejection port); 1B22C (swab of handgun grips); 1B39A (swab of stain on 1 Smith & Wesson magazine))] Davis's report states that a DNA mixture was obtained from a swab (Item 1B22D) of the trigger and trigger guard on the same handgun; the lab report states Davis's opinion: "John McCluskey and Casslyn Mae Welch cannot be eliminated as possible contributors to this DNA mixture." [Def's Ex. G6, Sept. 30, 2010 report, p. 2] Davis's April 27, 2011 lab report states that Davis also analyzed swabs of staining (Item 1B22E) on the underside of the slide above the barrel of the same handgun (Item 1B22) and determined that it was blood; the report states her opinion: "To a reasonable degree of scientific certainty, John McCluskey is the source of the DNA

identified on item 1B22E." [Def's Ex. G6, April 27, 2011 report; *see* Doc. No. 547, p. 4 (further describing location of stain)]

In addition, Davis analyzed "Touch DNA" swabs from the steering wheel (Item 31a) and from the gear shifter (Item 31g) of the Haases' pickup truck. [Def's Ex. G6, Dec. 22, 2010 report, pp. 1, 3] Davis's report states that a DNA mixture was obtained from both of these items and states, with respect to both Item 31a and Item 31g: "To a reasonable degree of scientific certainty, John McCluskey is the source of the major DNA profile resolved from this mixture." [*Id.*, p. 3] Davis further states her opinion, regarding Item 31a, that Welch, Province, Linda Haas, and Gary Haas are eliminated as contributors to this DNA mixture. [*Id.*] Regarding Item 31g, the report states that the minor DNA profile may be used for elimination purposes only, and that Welch, Province, and Linda Haas are eliminated as contributors of the minor DNA profile. [*Id.*]

Davis also analyzed swabs of red stain recovered from the pavement at a Phillips 66 gas station in Santa Rosa, New Mexico, Item R-6. [Doc. No. 547, p. 5; Def's Ex. G6, Dec. 22, 2010 report, pp. 2, 4] Davis's report states that a DNA mixture was obtained from Item R-6 and states her opinion that Linda Haas and Gary Haas "cannot be eliminated as possible contributors to this DNA mixture." [Def's Ex. G6, Dec. 22, 2010 report, p. 4] Davis states that Welch, Province, and Defendant "are eliminated as contributors to this DNA mixture." [*Id.*]

The Court is not currently aware of how many of the results and conclusions from Davis's lab reports the Government proposes to present at trial.

Defendant filed a motion to exclude the results of all of the Government's DNA testing. [Docs. No. 422, 442] The Government filed a Response [Doc. No. 547], and Defendant filed a Reply [Doc. No. 562]. Both parties also filed voluminous exhibits on CDs. [May 14, 2012; June

25, 2012] The Court admitted about 100 additional exhibits at the May 6-7, 2013, evidentiary hearing.

I. ADEQUACY OF DISCLOSURE PROVIDED BY GOVERNMENT

Defendant asserts that the Government's *Notice of Intention To Offer Expert Testimony* [Doc. No. 261] and the *Supplemental Notice of Intent To Offer Expert Testimony* [Doc. No. 386] do not comply with Rule 16. [Doc. No. 442, pp. 17-23]³ Defendant quotes the page-long summary of the Supplemental Notice regarding Carrie Zais (Davis), Supervising Forensic Scientist. [Doc. No. 442, pp. 18-20] This summary states that the Government provided Defendant with Davis's reports and "approximately 70 pages of methodology, testing analysis, results, notes, and national match detail report." [Doc. No. 442, p. 19] Defendant acknowledges that he received at least eleven pages from Davis's laboratory reports, together with "voluminous foundational material." [Doc. No. 442, pp. 20-23; Def's Ex. G6] Defendant asserts, however, that these documents do not "tell us what [her] conclusions are" and do not "begin to describe 'the bases and reasons for those opinions,'" as required by Rule 16. [Doc. No. 442, p. 20]

The Government responds that its disclosures meet the requirements of Rule 16 and satisfy the intent of the discovery requirements. [Doc. No. 547, pp. 5-6] The Government asserts that it has provided more than Rule 16 requires—including Davis's lab reports, the foundational data including protocols and standard operating procedure, internal and external audits, and proficiency tests. [Doc. No. 547, p. 6]

The Government was required to disclose expert evidence to be presented at trial under Rules 702, 703, or 705. In civil cases, Rule 26 requires a "written report" containing "a complete

³ The Court refers to the page numbers shown for Document No. 442, which are not the same as the page numbers typed on the bottom of each page of Defendant's Supplemental Memorandum; the Court notes that the each of the Doc. No. 442 page numbers is higher by 15 (since there are 15 introductory pages to the Supplemental Memorandum).

statement of all opinions the witness will express and the basis and reasons for them." Fed. R. Civ. P. 26(a)(2)(B)(i). The requirements in criminal cases are more limited; Rule 16 requires the Government to give Defendant only "a written summary" including "the witness's opinions, the bases and reasons for those opinions, and the witness's qualifications." Fed. R. Crim. P. 16(a)(1)(G). Rule 16 disclosure is designed to give the opposing party notice, permitting preparation for cross-examination and presentation of opposing experts. *See* Fed. R. Crim. P. 16 advisory committee's notes to 1993 amendment. Detailed, extensive discussion is not required in the Rule 16 summary: "Although the summary required by Rule 16 provides the defense with some notice, the requirement of setting forth 'the bases and reasons for' the witnesses' opinions does not track the methodological factors set forth by the Daubert Court." Margaret A. Berger, *Procedural Paradigms for Applying the Daubert Test*, 78 Minn. L. Rev. 1345, 1360 (1994).

The Government provided Defendant with a curriculum vitae for Carrie Zais (Davis), which Defendant provided to the Court as an exhibit.⁴ [Def's Ex. X6] Provision of the expert's curriculum vitae satisfies the requirement of Rule 16 to include a description of the witness's qualifications. *United States v. Mehta*, 236 F. Supp. 2d 150, 155 (D. Mass. 2002).

The Government provided Defendant with Davis's laboratory reports, eleven pages of which were provided to the Court by Defendant. [Def's Ex. G6] These reports sufficiently notified Defendant of Davis's opinions. For instance, the September 30, 2010 report, at page 2, informs Defendant that Davis can be expected to testify to her opinion that, "[t]o a reasonable degree of scientific certainty, John McCluskey is the source of the major DNA profile" obtained from items 1B22A, 1B22B, 1B22C, and 1B39A. The "voluminous foundational material" Defendant acknowledges receiving—including the methodology, testing analysis, results, notes,

⁴ The Government provided an updated CV, now showing the analyst's name as Carrie Zais Davis, at the May 2013 evidentiary hearing. [Gov's Ex. 4 (5/6/13)]

and national match detail report—was sufficient to describe "the bases and reasons for those opinions" under Rule 16. In addition, the Government's disclosure notice informed Defendant that Davis is also expected to testify regarding collection of samples, the chain of custody, lab controls in place to protect the integrity of the samples, and the peer review process used in the analysis of these samples and subsequent comparison. [Doc. No. 386; *see* Doc. No. 442, p. 19]

The Tenth Circuit rejected similar arguments that a Rule 16 disclosure failed to sufficiently convey an expert's opinions and the bases and reasons for those opinions. In *Brown*, the government provided a fingerprint examiner's CV and report, and the summary of testimony stated that the expert "will testify that she compared the defendant's known fingerprints found on fingerprints [sic] cards with a latent fingerprint found" on a job application, and "will testify the latent fingerprint on the job application is the defendant's fingerprint." *United States v. Brown*, 592 F.3d 1088, 1089 n.2 (10th Cir. 2009). At trial, the expert testified that she found fourteen identical points of comparison between the defendant's known print and the latent print found at the crime scene. *Id.* at 1089. The Tenth Circuit "was unpersuaded by Brown's argument that because the government's summary failed to mention fourteen identical points of comparison or specifically describe the expert's methodology, the summary was deficient." *Id.* at 1091. The Tenth Circuit held that the government's disclosure substantially complied with Rule 16 because the summary and report stated the expert's opinion and described the anticipated testimony—that "the fingerprint found at the scene of the crime matched Brown's." *Id.* at 1091.

The Tenth Circuit opinion in *Brown* shows that Rule 16 disclosures are not required to include the extensive and exhaustive level of detail and information for which Defendant is arguing. The Court finds that the Government's disclosures meet the requirements of Rule 16.

Defendant also asserts that the Government's notice was late, under the Court's Scheduling Order. [Doc. No. 442, p. 18] It is not necessary for the Court to consider this issue further other than to observe that it is Defendant's burden to "demonstrate" prejudice—either from the timing or the adequacy of the Government's disclosure. *See United States v. Kenyon*, 481 F.3d 1054, 1062 (8th Cir. 2007). Summarily asserting prejudice does not satisfy Defendant's burden to demonstrate prejudice. *See United States v. Apperson*, 441 F.3d 1162, 1204 (10th Cir. 2006) (regarding denial of motion to continue). The purposes of Rule 16 include minimizing surprise from unexpected expert testimony and allowing a party to prepare for cross-examination and presentation of opposing experts. Fed. R. Crim. P. 16 advisory committee's note to 1993 amendment. Defendant has not demonstrated that the purposes of the Rule are frustrated. *See United States v. Thornton*, 642 F.3d 599, 606 (7th Cir. 2011); *United States v. Stevens*, 380 F.3d 1021, 1026 (7th Cir. 2004) (prejudice under Rule 16 requires showing of undue surprise and inadequate opportunity to prepare defense). Defendant's very thorough pleadings and exhibits in support of his motion to exclude DNA evidence show that Defendant has had adequate notice to enable him to prepare a defense. In addition, the Court does not find any indication that the Government has acted in bad faith.

The Court finds that the Government's disclosure satisfies Rule 16. Even if the Court had found any violation, the Court would have been required to impose the least severe sanction that would fulfill the purposes of Rule 16. *Brown*, 592 F.3d at 1090. Rule 16(d)(2) provides a variety of possible sanctions. "In selecting a proper sanction, a court should typically consider (1) the reasons the government delayed producing requested materials, including whether the government acted in bad faith; (2) the extent of prejudice to defendant as a result of the delay; and (3) the feasibility of curing the prejudice with a continuance." *United States v. Charley*, 189

F.3d 1252, 1262 (10th Cir. 1999) (internal quotation marks omitted). "Frequently it will be found that the party who requested disclosure has not been prejudiced and that no sanction is needed." *Id.* (internal quotation marks omitted). The record before this Court shows that Defendant has been provided, well in advance of trial, lab reports and extensive foundational material; Defendant thus knows "well in advance of trial who [is] going to testify and the nature and purpose of the expected testimony." *Charley*, 189 F.3d at 1262. Exclusion of expert evidence "is almost never imposed in the absence of a constitutional violation or statutory authority for such exclusion." *Id.* (internal quotation marks omitted). The extreme sanction of exclusion would not be warranted in this case, even if the Court had found any violation.

Since the purposes of Rule 16 have been satisfied, and the Court finds no evidence of bad faith in any delays, there is no basis for any sanction. *See id.*

In addition, since Defendant has requested, and been granted, a continuance of the trial date, the Court finds that any prejudice from any failure to fully comply with disclosure will be cured. *Charley*, 189 F.3d at 1262. The Court finds that Defendant has sufficient time to prepare for trial, there is no unfair surprise, and no sanctions are warranted.

II. NO NECESSITY FOR A SEPARATE, PRETRIAL DAUBERT HEARING

Defendant asks the Court to hold a *Daubert* hearing. [Doc. No. 442, p. 98] *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579 (1993). The Government argues that a pretrial *Daubert* hearing is unnecessary. [Doc. No. 547, pp. 57-58] The Court agrees that a separate, pretrial *Daubert* hearing is not warranted—except for a hearing on LCN testing, which was held on May 6-7, 2013; a sufficient record on other issues has already been presented in the hundreds of pages of briefs and thousands of pages of exhibits.

"The most common method for fulfilling [the gatekeeper function] is a *Daubert* hearing, although such a process is not specifically mandated.'" *United States v. Turner*, 285 F.3d 909, 913 (10th Cir. 2002) (quoting *Goebel v. Denver & Rio Grande W. R.R. Co.*, 215 F.3d 1083, 1087 (10th Cir. 2000)). "*Daubert* challenges, like other preliminary questions of admissibility, are governed by Fed. R. Evid. 104." *United States v. Nichols*, 169 F.3d 1255, 1263 (10th Cir. 1999). Rule 104 "provides that a hearing outside the presence of the jury 'shall be . . . conducted when the interests of justice require.'" *Id.* (quoting Fed. R. Evid. 104 (amended 2011, *see* Fed. R. Evid. 104 advisory committee's note (explaining that 2011 amendments are part of the restyling of the Rules and intended to be stylistic only; there is no intent to change any result in any ruling))). "The requirement of the 'interests of justice' implies discretion on the part of the trial court to be reviewed only for an abuse." *Id.*

The Court is required to make "a preliminary assessment of whether the reasoning or methodology underlying the testimony is scientifically valid and of whether that reasoning or methodology properly can be applied to the facts in issue." *Daubert*, 509 U.S. at 592-93. The Court must also determine whether the proffered witness is qualified as an expert. The opinions give this Court "considerable leeway" in "deciding *how* to test an expert's reliability, and to decide whether or when special briefing or other proceedings are needed to investigate reliability." *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 152 (1999); *see Turner*, 285 F.3d at 913. "The trial court enjoys broad latitude in executing its gate-keeping function; there is no particular procedure it is required to follow." *United States v. Vargas*, 471 F.3d 255, 261 (1st Cir. 2006). The Supreme Court has emphasized the importance of "considerable leeway," because broad discretion is needed to allow the Court both to avoid "unnecessary 'reliability'

proceedings" and to require "appropriate proceedings" when necessary. *Kumho Tire*, 526 U.S. at 152; *see Nichols*, 169 F.3d at 1262-63; *Vargas*, 471 F.3d at 261-62.

In *Nichols*, the defendant challenged the admissibility of opinions by a forensic explosives expert about the type and size of the bomb that destroyed the Murrah building in Oklahoma City. The defendant challenged the FBI laboratory's protocol and procedures, and also challenged the manner in which the lab work was performed; the defendant's challenges included arguments that the FBI laboratory lacked proper protocols and prescribed procedures, that the testing methodologies used were inappropriate, that unqualified persons participated in performing the test, that the equipment was not properly maintained, and that discovery information suggested the possibility of contamination. *Nichols*, 169 F.3d at 1262-63. "In sum, the defense argue[d] that the government must prove to the court, outside the presence of the jury, that appropriate scientific methods were properly applied before the test results and conclusions drawn from them can be admitted as relevant and reliable scientific evidence." *Id.* at 1262 (internal quotation marks omitted).

The district court in *Nichols* declined to hold a pretrial *Daubert* hearing and reserved ruling on admissibility until the testimony was offered at trial. *Id.* The Tenth Circuit held that the court did not abuse its discretion, because a separate, pretrial hearing is not required in order for a district court to properly fulfill its gatekeeping function. *Id.* at 1263.

The district court in *Nichols* stated that the evidence did not involve "any new scientific theory and the testing methodologies are neither new nor novel." *Id.* at 1263. The district court stated that "the contentious issue was whether the test results were undercut by flaws in the laboratory tests, a matter involving the credibility of witnesses and weighing of the evidence, both of which were more suitable for resolution by the jury." *Id.*

The district court in *Nichols* reasoned that the showing required to determine admissibility was also evidence that must be presented to the jurors to allow them to assess the weight and credibility of the expert opinion evidence. *Id.* at 1263-64. The Tenth Circuit agreed, quoting the Advisory Committee Notes to Rule 104: "Not infrequently the same evidence which is relevant to the issue of establishment of fulfillment of a condition precedent to admissibility is also relevant to weight or credibility" *Id.* at 1264. The district court concluded: "Because the accused has the right to have the jury hear evidence relevant to the weight and credibility of opinion evidence, the necessary foundation for admission should be presented to the jury"; and "That procedure avoids the duplication that would result from a pretrial hearing." *Id.* at 1263-64. Again the Tenth Circuit agreed, stating that the district court's "method of conserving judicial resources" was consistent with the Advisory Committee Notes to Rule 104:

[T]ime is saved by taking foundation proof in the presence of a jury. Much evidence on preliminary questions, though not relevant to jury issues, may be heard by the jury with no adverse effect. A great deal must be left to the discretion of the judge who will act as the interests of justice require.

Nichols, 169 F.3d at 1264 (quoting Fed. R. Evid. 104 advisory committee's note). The district court in *Nichols* ruled that the necessary foundation would be proved, and the district court would determine the adequacy of that showing, before the expert would be permitted to give opinions and conclusions. *Id.* at 1263. The district court also stated that if voir dire would be too prolonged or would include matters inappropriate for the jury to hear, the voir dire could be conducted outside the jury's presence. *Id.*

The Tenth Circuit stated that the district court's actions in *Nichols* were "flawless." *Id.* at 1264. The Tenth Circuit held that "'*Daubert* does not mandate an evidentiary hearing," and, on appeal, the Court "simply require[s] 'a sufficiently developed record in order to allow a

determination of whether the district court properly applied the relevant law.'" *Nichols*, 169 F.3d at 1262 (quoting *United States v. Call*, 129 F.3d 1402, 1405 (10th Cir. 1997)).

The Tenth Circuit observed that the procedure followed by the district court in *Nichols* was consistent with the Tenth Circuit's opinion in *Davis*. *Nichols*, 169 F.3d at 1264. In *Davis*, there was a lengthy hearing on the DNA evidence before the jury and without objection from the defendant; the expert witness was examined, and cross-examined, about compliance with protocol before she gave her opinion. *United States v. Davis*, 40 F.3d 1069, 1075 (10th Cir. 1994). The court then overruled the defendants' objection and allowed the witness to give her opinion. *Id.* "The district court thus had the opportunity to determine whether protocol was followed before [the expert witness] testified that the samples matched [the defendants] and explained her statistical calculations." *Id.* The Tenth Circuit approved this procedure, stating that the district court in *Davis* "thus conducted the functional equivalent of a preliminary hearing." *Id.*

More recently, the Tenth Circuit again held that a separate, pretrial *Daubert* hearing is not specifically mandated. *United States v. Nacchio*, 555 F.3d 1234, 1253-54 (10th Cir. 2009) (en banc). A party has "no entitlement to a particular method of gatekeeping by the district court." *Id.* at 1245. The Tenth Circuit stated, "Other circuits are in accord with the Tenth Circuit view." *Id.* at 1254 n.18 (citing additional cases); see *United States v. Alatorre*, 222 F.3d 1098, 1099-1104 (9th Cir. 2000).

In determining that a separate, pretrial hearing is not required under *Daubert*, the Court observes that a number of courts have held that judicial notice of the reliability of PCR/STR DNA analysis can be taken. See, e.g., *United States v. Beasley*, 102 F.3d 1440, 1448 (8th Cir.

1996); *State v. Butterfield*, 27 P.3d 1133, 1143 (Utah 2001). The Court does not take judicial notice in this case, but rather determines on the basis of the record before the Court, that the

Government's DNA evidence is admissible (with the exception of LCN evidence); however, cases holding that courts may take judicial notice of the reliability of PCR/STR DNA evidence further support the Court's determination that a separate, pretrial *Daubert* hearing is not necessary in this case.

In the case before the Court, the briefs on the DNA evidence are more than two hundred pages long and the exhibits submitted by the parties exceed three thousand pages (plus additional exhibits on LCN testing). The parties have cited numerous additional authorities. The parties have fully briefed the issues. The Court has not placed a limitation on the information upon which to base the *Daubert* decision. Compare *Dodge*, 328 F.3d at 1223-24, 1228 (district court has discretion to limit information, but abused discretion in rejecting 47-page motion with several-thousand-page appendix and imposing 20-page limit on brief plus appendix, and declining to accept proffers of reports and studies; taken together with other limitations, court severely and unreasonably limited information), with *Nacchio*, 555 F.3d at 1250 (no unreasonable limitation of information). The parties were allowed to exceed normal page limits in their briefs and to present written submissions. See *Group Health Plan, Inc.*, 344 F.3d at 761 n.3. In this case, the Court has granted generous page extensions, allowing Defendant his requested extension to 144 pages for the motion to exclude DNA evidence. [Doc. No. 428] In addition, despite concluding that Defendant exceeded the page extension granted, the Court denied the Government's motion to strike [Doc. No. 443, filed May 11, 2012]; the Court accepted and fully reviewed Defendant's motion. [Doc. No. 1008, filed June 7, 2013]

The Court finds that there is a sufficient record for decision and that the parties have been provided ample opportunity to be heard. The Court held an evidentiary hearing on LCN testing; the Court finds that a separate, pretrial *Daubert* hearing is unnecessary on other DNA issues. The Federal Rules seek to avoid "unjustifiable expense and delay" as part of their search for truth and the just determination of proceedings. *Kumho*, 526 U.S. at 153 (quoting Fed. R. Evid. 102). But, more important, the Court finds that the foundation for admissibility under *Daubert* is the same information that must be presented to the jurors to allow them to determine the weight and credibility of the expert evidence; Defendant therefore has the right to have the jury hear this evidence. *See Nichols*, 169 F.3d at 1263-64. The evidence which would be presented at a separate, pretrial *Daubert* hearing can be presented to the jury at trial.

The Court emphasizes that the Government must lay the foundation for admissibility under *Daubert* before any expert opinions or conclusions are given. *See Nichols* 169 F.3d at 1263; Fed. R. Evid. 705 (court can order that expert first testify to underlying facts or data, before giving opinion). This ruling applies to all DNA evidence; in addition, with regard to evidence from mixed samples, the Government is ordered to lay a foundation demonstrating that the DNA result does not constitute LCN testing with respect to any contributor for whom the Government wants to introduce a DNA result.

Defendant's motion for a separate, pretrial *Daubert* hearing on issues other than LCN testing is denied.

III. DNA TESTING IN THIS CASE

The Government states that the NMDPS DNA Laboratory used the following in this case: Quantifiler Duo DNA Quantification Kit; AmF1STR Identifiler PCR Amplification Kit; Applied Biosystems 7500 Real-Time PCR SDS Software, version 1.2.3.; Applied Biosystems

3130 Genetic Analyzer Data Collection Software, version 3.0; Applied Biosystems GeneMapper ID Software, version 3.2; FBI Popstats software, version 5.7.4; ABI Prism 3130 Genetic Analyzer. [Doc. No. 547, pp. 7-8] The Identifiler kit amplifies fifteen STR loci, including the thirteen core DNA markers used in the Combined DNA Index System (CODIS), and two internationally accepted STRs. [Gov's Ex. 14 (6/25/12)]

As the Government points out, some of Defendant's arguments and challenges concern procedures not used in this case, and they need not be addressed by this Court.

IV. ADMISSIBILITY OF DNA EVIDENCE

A. Legal Standard Governing Admissibility Under *Daubert* and Rule 702

The admission of expert testimony is governed by Federal Rule of Evidence 702 and the Rule's interpretation by the Supreme Court in *Daubert*, *Joiner*, and *Kumho Tire*. *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579 (1993); *General Elec. Co. v. Joiner*, 522 U.S. 136 (1997); *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999). Rule 702 was amended in 2000 in response to *Daubert* and *Kumho Tire*. Fed. R. Evid. 702 advisory committee's note. The 2000 amendment affirms the trial court's role as gatekeeper, excluding unreliable expert testimony.⁵

Id. Rule 702 provides:

A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if:

- (a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;
- (b) the testimony is based on sufficient facts or data;
- (c) the testimony is the product of reliable principles and methods; and

⁵ Rule 702 was further amended in 2011 as part of the restyling of the Rules of Evidence, to make them more easily understood; these changes are "stylistic only" and there "is no intent to change any result in any ruling on evidence admissibility." Fed. R. Evid. 702 advisory committee's note to 2011 amendment.

(d) the expert has reliably applied the principles and methods to the facts of the case.

The proponent of the evidence has the burden of showing that expert evidence is admissible, by a preponderance of proof. *Daubert*, 509 U.S. at 592 n.10; *United States v. Orr*, 692 F.3d 1079, 1091 (10th Cir. 2012); Fed. R. Evid. 702 advisory committee's note to 2000 amendment. The trial court has "wide latitude" in exercising its discretion to admit or exclude expert testimony. *Bitler v. A.O. Smith Corp.*, 400 F.3d 1227, 1232 (10th Cir. 2004); see *Kumho*, 526 U.S. at 147 ("broad latitude" in determining how to determine reliability and in ultimate reliability determination).

The trial court "generally must first determine whether the expert is qualified." *United States v. Avitia-Guillen*, 680 F.3d 1253, 1256 (10th Cir. 2012) (quoting *United States v. Nacchio*, 555 F.3d 1234, 1241 (10th Cir. 2009) (en banc)). "If the expert is sufficiently qualified, then 'the court must determine whether the expert's opinion is reliable by assessing the underlying reasoning and methodology.'" *Id.* (quoting *Nacchio*, 555 F.3d at 1241). Trial courts have the responsibility of ensuring that scientific testimony or evidence is both relevant and reliable. *Daubert*, 509 U.S. at 589. "Relevant evidence 'means evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence.'" *Bitler*, 400 F.3d at 1234 (quoting Fed. R. Evid. 401). The trial court acts as gatekeeper, making "a preliminary assessment of whether the reasoning or methodology underlying the testimony is scientifically valid and of whether that reasoning or methodology properly can be applied to the facts in issue." *Daubert* 509 U.S. at 592-93. The gatekeeping function requires a "sufficiently developed record" to allow a determination of whether the trial court "properly applied the relevant law." *Avitia-Guillen*, 680 F.3d at 1258 (quoting *Nichols*, 169 F.3d at 1262).

Daubert sets forth a non-exclusive list of factors that may be considered, including: (1) whether the theory or technique can be, and has been, tested; (2) whether the theory has been subjected to peer review and publication; (3) the known or potential rate of error; (4) the existence and maintenance of standards controlling the technique's operation; and (5) whether the theory is generally accepted in the relevant scientific community. *Daubert*, 509 U.S. at 593-94. The trial court need not apply all of these factors. *Avitia-Guillen*, 680 F.3d at 1258. The trial court may consider additional relevant factors. *Kumho Tire*, 526 U.S. at 149-50.

The *Daubert* Court emphasized that the inquiry under Rule 702 is "a flexible one." *Daubert*, 509 U.S. at 594. "Its overarching subject is the scientific validity—and thus the evidentiary relevance and reliability—of the principles that underlie a proposed submission." *Id.* at 594-95. "The focus, of course, must be solely on principles and methodology, not on the conclusions that they generate." *Id.* at 595. *Joiner* added that "conclusions and methodology are not entirely distinct from one another." *Joiner*, 522 U.S. at 146. A court need not admit opinion evidence "that is connected to existing data only by the *ipse dixit* of the expert." *Id.* "A court may conclude that there is simply too great an analytical gap between the data and the opinion proffered." *Id.*

The Federal Rules encourage the admission of expert testimony. 4 Jack B. Weinstein & Margaret A. Berger, *Weinstein's Federal Evidence* § 702.02[1], at 702-5 (Joseph M. McLaughlin, ed., Matthew Bender 2d ed. 2012). The *Daubert* Court recognized the "liberal thrust" of the Federal Rules and their "general approach of relaxing the traditional barriers to 'opinion' testimony." *Daubert*, 509 U.S. at 588 (internal quotation marks omitted). "The presumption under the Rules is that expert testimony is admissible." 4 Weinstein & Berger, *Weinstein's Federal Evidence* § 702.02[1], at 702-5. "A review of the caselaw after *Daubert*

shows that the rejection of expert testimony is the exception rather than the rule." Fed. R. Evid. 702 advisory committee's note to 2000 amendment. As the Advisory Committee explained, "the trial court's role as gatekeeper is not intended to serve as a replacement for the adversary system." *Id.* (quoting *United States v. 14.38 Acres of Land*, 80 F.3d 1074, 1078 (5th Cir. 1996)). "As the Court in *Daubert* stated: 'Vigorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence.'" *Id.* (quoting *Daubert*, 509 U.S. at 596). These conventional devices, rather than exclusion under the restrictive and elevated standard set by *Frye*, are "the appropriate safeguards where the basis of scientific testimony meets the standards of Rule 702." *Daubert*, 509 U.S. at 596. "As the ultimate fact-finder, it is the jury that must determine, finally, where the truth in any case lies, and the district judge as gatekeeper may not usurp this function." *United States v. Frazier*, 387 F.3d 1244, 1272 (11th Cir. 2004).

B . Qualifications of Government's Witness, Carrie Zais Davis

The Government provided Defendant with the curriculum vitae of its proposed DNA expert, Carrie Zais Davis. [Def's Ex. X6; Gov's Ex. 4 (5/6/13) (updated CV)] At the May 6, 2013 evidentiary hearing, additional information was provided about Davis's qualifications; without objection from Defendant, Davis was qualified to testify as an expert in DNA analysis. [Tr. 5/6/13, p. 130]

Davis obtained a B.A. in Biology from the University of Texas, Austin, in 2000. In 2003-2004, Davis took courses in: statistical analysis of forensic DNA evidence, population genetics, and biochemistry. [Tr. 5/6/13, p. 120; Def's Ex. X6] Between 2003 and 2011, Davis attended twelve seminars or workshops. She testified, however, that she did not believe she had

ever attended a class on LCN testing. [Tr. 5/6/13, p. 169] She is a member of the American Academy of Forensic Sciences.

Davis worked as a paternity laboratory technician at Orchid GeneScreen for one year. She then worked at Orchid Cellmark as a CODIS DNA analyst for eight months and as a Forensic DNA Analyst for the next five years. For the following three years, Davis worked at the New Mexico Department of Public Safety Laboratory as a "Forensic Scientist, Advanced," in the Biology/DNA Unit. From October, 2010, to the present Davis was the "Supervising Forensic Scientist, Advanced."

The Government's Response states that Davis "has been responsible for and qualified to perform, DNA extractions, mixed stains analysis, STR/PCR analysis, serological evaluation, report writing and statistical interpretation, paternity testing, and database (CODIS) analysis." [Doc. No. 547, p. 3] Davis testified that she had worked on about 1500 DNA analyses. [Tr. 5/6/13, p. 119] The Government states that Davis "completed extensive in-house training on both the AmpF1STR Identifiler Amplification Kit" and the 3130 Genetic Analyzer. [Doc. No. 547, p. 3] Davis takes two proficiency tests per year, as required in a CODIS-participating lab; Defendant was provided with the results of five proficiency tests. [Tr. 5/6/13, p. 123; Doc. No. 547, p. 6 n.6] Davis has testified as a DNA expert eleven times. [Tr. 5/6/13, pp. 129-30]

In a case involving a witness with similar, though lesser, qualifications than Davis, the Tenth Circuit held "meritless" a claim that the witness was not qualified as a DNA expert. *Wilson v. Sirmons*, 536 F.3d 1064, 1102 (10th Cir. 2008) (opinion reinstated after rehearing en banc, *sub nom. Wilson v. Workman*, 577 F.3d 1284, 1287 (10th Cir. 2009)). The witness in *Wilson* had worked as a criminalist with the Oklahoma State Bureau of Investigation for seven and one-half years; she had a B.Sc. in chemistry, had received training in DNA testing, and had

testified six times as a DNA analyst. *Id.* The Tenth Circuit held that the claim was "meritless," and that the petitioner had not demonstrated "any error" in qualifying the witness as an expert. *Id.* (emphasis added). The Tenth Circuit was reviewing a due process claim of plain error in a federal habeas case, so could have affirmed based on a lower standard; the language used by the Tenth Circuit, however, shows that the court would have reached the same conclusion on the standard applicable for a preserved claim under Rule 702.

Davis has twelve years of experience in DNA analysis. Davis holds the position of Supervising Forensic Scientist, Advanced—apparently a higher title than the witness in *Wilson*. The Tenth Circuit's opinion in *Wilson* constitutes persuasive authority that Davis is qualified as a DNA expert. *See also Vargas*, 471 F.3d at 258-60, 262 (witness qualified as fingerprint expert on basis of many years of experience, though witness lacked degrees in science); *Butterfield*, 27 P.3d at 1140 (lab supervising criminalist, with only B.Sc. in medical technology, was qualified as expert in DNA analysis largely by extensive experience together with further training and short courses); *Patterson v. State*, 729 N.E.2d 1035, 1040 (Ind. Ct. App. 2000) (DNA supervisor, with only bachelor's degree in biochemistry, was qualified as expert in DNA analysis by 10 years in forensic serology department and about 5 years in DNA Unit, and several classes in PCR analysis). A witness may even be qualified as an expert on the basis of experience alone, as the text of the rule states. Fed. R. Evid. 702 advisory committee's note to 2000 amendment ("Nothing in this [2000] amendment is intended to suggest that experience alone—or experience in conjunction with other knowledge, skill, training or education—may not provide a sufficient foundation for expert testimony.").

Defendant's motion raises a number of questions about Davis's qualifications:

(1) In his 2012 motion to dismiss, Defendant observes that the documents that had been provided by that time did not show whether Davis had met continuing-education requirements. [Doc. No. 442, pp. 106-07] At the May 6, 2013 hearing, however, Davis testified that she always fulfilled or exceeded her continuing-education requirement of eight hours per year. [Tr. 5/6/13, p. 120]

(2) Defendant raises a question regarding forms showing "K. Zais" or "Katherine Zais" working as "technical support personnel." [Doc. No. 442, p. 106 (regarding forms included in Def's Ex. X6)] The Government responds that those documents do not concern Carrie Zais Davis, but her sister Katherine Zais. [Doc. No. 547, p. 3 n.3]

(3) Defendant speculates that Davis may not be sufficiently familiar with the Identifiler kit. [Doc. No. 442, p. 107] This speculation is, at most, a suggestion of a gap in Davis's qualifications or knowledge. But "[g]aps in an expert witness's qualifications or knowledge generally go to the weight of the witness's testimony, not its admissibility." *Robinson*, 447 F.3d at 1100 (internal quotation marks omitted). Davis's familiarity with the Identifiler kit is a subject Defendant may explore on cross-examination at trial; any lack of familiarity would not be a reason to refuse to qualify her as a DNA expert. *See First Union Nat'l Bank v. Benham*, 423 F.3d 855, 862 (8th Cir. 2005) (factual basis goes to credibility, not admissibility). The Court observes that the Government states that Davis "completed extensive in-house training" on the Identifiler kit. [Doc. No. 547, p. 3]

(4) Defendant suggests that Davis may be biased, because she works for a lab closely aligned with a police department. [Doc. No. 442, pp. 85-86, 107] This, again, is a proper subject for cross-examination; evidence of bias would not be a proper basis for exclusion of expert testimony. *Cruz-Vazquez v. Mennonite Gen. Hosp.*, 613 F.3d 54, 59 (1st Cir. 2010); *see*

United States v. Baldridge, 559 F.3d 1126, 1135 (10th Cir. 2009) (proper subject for cross-examination of any witness is question of bias). The issues to which the Court must apply its gatekeeping role under *Daubert* must be distinguished from the issues properly left to the jury. It is the Court's role to make a preliminary determination of whether Davis has sufficient specialized training or knowledge to qualify as an expert. But it is the jury's role to assess any potential bias and the impact of any bias on the weight to give her testimony. *Cruz-Vazquez*, 613 F.3d at 59.

(5) Defendant suggests that, although he was provided with the results of five successful proficiency tests, blind proficiency tests would have provided better quality assurance. [Doc. No. 442, pp. 145-47] Defendant also suggests that a DNA analyst should be certified, citing National Research Council, *Strengthening Forensic Science in the United States: A Path Forward*, p. 208 (2009) [hereinafter NRC (2009)]. [Doc. No. 442, pp. 105-06, 144-45] Defendant argues that Davis may be qualified "to testify to the procedures she used in this case," but that her CV does not demonstrate that she is qualified "to testify about molecular biology, to make estimates of population frequencies, or to establish that a biological methodology or an estimation procedure is valid evidence or generally accepted." [Doc. No. 442, p. 106]

Certification may indicate that an expert's opinion is entitled to greater weight, but such certification is not a prerequisite to qualification as an expert witness. *Pages-Ramirez v. Ramirez-Gonzalez*, 605 F.3d 109, 114 (1st Cir. 2010). A court abuses its discretion if it refuses to qualify a witness as an expert solely because the expert does not have the degree or specialization that the court considers to be most appropriate. *Id.* As indicated by the use of the disjunctive "or" in Rule 702, any one of the five bases listed in the Rule may be sufficient. *Lavespere v. Niagara Mach. & Tool Works, Inc.*, 910 F.2d 167, 176 (5th Cir. 1990), *abrogated on*

other grounds by *Little v. Liquid Air Corp.*, 37 F.3d 1069, 1075 n.14 (5th Cir. 1994); 4 Weinstein & Berger, *Weinstein's Federal Evidence* § 702.04[1][c], at 702-57; 29 Charles Alan Wright et al., *Federal Practice and Procedure: Evidence* § 6265 (1997 & 1st ed. 2012). A witness may be qualified as an expert on the basis of experience alone. *Nacchio*, 555 F.3d at 1258; Fed. R. Evid. 702 advisory committee's note to 2000 amendment.

Similarly, if Davis had taken blind proficiency tests, passing them might have bolstered her qualifications more than the proficiency tests administered by NMDPS, which are not "blind." See *People v. Lehmkuhl*, 117 P.3d 98, 103-04 (Colo. Ct. App. 2004). But open proficiency tests satisfy TWGDAM⁶ guidelines. National Research Council, *The Evaluation of Forensic DNA Evidence*, p. 79 (1996) [hereinafter NRC II].

The Court finds that Defendant's arguments go to the weight of Davis's testimony, not to its admissibility. Additional attributes might have bolstered Davis's qualifications, but they are not necessary for a witness to qualify as an expert. The Court concludes that Carrie Zais Davis is qualified to testify as an expert in DNA analysis. Davis's qualifications meet or exceed those of the witness determined to be qualified by the Tenth Circuit in *Wilson*, 536 F.3d at 1102. The Court places considerable emphasis on Davis's extensive practical experience.

C. Reliability of PCR/STR Methodology

The PCR/STR method of DNA analysis was used in this case. [Doc. No. 547, p. 8; Def's Ex. G6] Defendant states that he is raising the issue of whether PCR/STR testing is generally reliable. [Doc. No. 442, p. 97]

Back in 1997, the *Shea* court observed that "although PCR is a relatively new technology, it is based on sound scientific methods and it has quickly become a generally

⁶ TWGDAM is the Technical Working Group on DNA Analysis Methods, a group of forensic DNA analysts from government and private laboratories who developed guidelines on quality control and quality assurance; their guidelines "define currently accepted practice." NRC II, p. 24.

accepted technique in both forensic and non-forensic settings." *United States v. Shea*, 957 F. Supp. 331, 338 (D.N.H. 1997), *aff'd*, 159 F.3d 37 (1st Cir. 1998). "The PCR Typing methods used by the FBI in this case readily satisfy Rule 702's reliability requirement." *Id.* In concluding that the methodology is reliable, courts rely on relevant scientific and forensic literature including NRC II, published in 1996. *Lemour v. State*, 802 So. 2d 402, 405 (Fla. Dist. Ct. App. 2001). "Perhaps the strongest evidence on this point is the conclusion reached by the National Research Council's Committee on Forensic DNA Science that 'the molecular technology [on which PCR is based] is thoroughly sound and . . . the results are highly reproducible when appropriate quality-control methods are followed.'" *Shea*, 957 F. Supp. at 338-39 (quoting NRC II, p. 23 (1996)). "In addition, the NRC's conclusion is supported by numerous studies published in both scientific and forensic journals which show widespread use of the STR technique in DNA analysis" *Lemour*, 802 So. 2d at 405-06 (internal quotation marks omitted).

By 2001, many more opinions held that PCR/STR testing was reliable and admissible, both under *Frye* and under Rule 702. *Lemour*, 802 So. 2d at 405. The *Lemour* court concluded that the PCR/STR method is "generally accepted by the relevant scientific community"—thus meeting the elevated *Frye* standard applicable in Florida courts. *Id.* at 406. PCR/STR testing had achieved widespread acceptance and "overwhelming endorsement" in both scientific and forensic journals. *Butterfield*, 27 P.3d at 1142-43 (citing articles); *see United States v. Trala*, 162 F. Supp. 2d 336, 347-48 (D. Del. 2001) (PCR/STR profiling is generally accepted by the relevant scientific community, widely accepted in the U.S. and internationally), *aff'd*, 386 F.3d 536 (3d Cir. 2004); *Stills v. Dorsey*, 7 Fed. Appx. 856, 859 (10th Cir. 2001) (unpublished) (concluding N.M. Supreme Court's holding that PCR testing is admissible under *Daubert* not contrary to federal law). The Utah Supreme Court observed in 2001 that "PCR-based testing,

which encompasses STR testing, has been held to be a scientifically correct and reliable technique by a vast majority of courts in other jurisdictions." *Butterfield*, 27 P.3d at 1143 (citing cases). The Colorado Supreme Court concluded in 2001: "The majority of courts in other jurisdictions that have considered the issue have held that DNA evidence derived from the PCR testing method satisfies the standards for admissibility under either *Frye* or Rule 702." *People v. Shreck*, 22 P.3d 68, 79 (Colo. 2001) (en banc) (citing cases).

By 2003, additional cases observed that the majority of jurisdictions addressing the issue held that PCR/STR testing was scientifically reliable and admissible. *State v. Whitley*, 821 A.2d 1086, 1094 (N.H. 2003); see *State v. Traylor*, 656 N.W.2d 885, 891, 900 (Minn. 2003) (holding, under the restrictive *Frye* test, that PCR/STR testing is "generally accepted in the relevant scientific community"). The *Whitley* court observed that "PCR-based STR DNA testing is recognized and used in virtually every State and by the Federal Bureau of Investigation." *Whitley*, 821 A.2d at 1094. A New Jersey court observed: "It would appear that every appellate court in the nation that has addressed the issue has accepted the scientific reliability of STR technology." *State v. Deloatch*, 804 A.2d 604, 613 (N.J. Super. Ct. Law Div. 2002) (applying *Frye*); see *Wilson v. Sirmons*, 536 F.3d 1064, 1102 (10th Cir. 2008) ("Numerous federal and state courts as well as scientific investigators have found that PCR DNA analysis is reliable."). Acceptance of PCR/STR testing by the courts indicates that this evidence is reliable. *United States v. Goxcon-Chagal*, 885 F. Supp. 2d 1118, 1137 (D.N.M. 2012). Although a reliability assessment under *Daubert* does not require determination that the methodology is "generally accepted" in the relevant scientific community, the *Daubert* Court stated that widespread acceptance is one of the factors in favor of admissibility under Rule 702. *Daubert*, 509 U.S. at 594. For this reason, cases holding that PCR/STR testing is "generally accepted" under the

elevated *Frye* test are persuasive support for the conclusion that this methodology is reliable under Rule 702 and *Daubert*.

In 2009, the National Research Council stated that "nuclear DNA analysis . . . has been rigorously shown to have the capacity to consistently, and with a high degree of certainty, demonstrate a connection between evidence and a specific individual or source." NRC (2009), p. 7. DNA typing is "universally recognized as the standard against which many other forensic individualization techniques are judged." *Id.* at 130. "DNA enjoys this preeminent position because of its reliability and the fact that, absent fraud or an error in labeling or handling, the probabilities of a false positive are quantifiable and often minuscule." *Id.* at 130.

Daubert recognized that "theories that are so firmly established as to have attained the status of scientific law, such as the laws of thermodynamics, properly are subject to judicial notice." *Daubert*, 509 U.S. at 592 n.11. On this basis, a number of courts have held that it is proper to take judicial notice of the reliability of PCR/STR analysis, even under the restrictive *Frye* test. *See, e.g., United States v. Beasley*, 102 F.3d 1440, 1448 (8th Cir. 1996); *Butterfield*, 27 P.3d at 1142-43.

Considering the *Daubert* factors, it is clear that the PCR/STR method can be and has been extensively tested, it has been subjected to peer review and publication, there is a low error rate according to NRC (2009), and there are controls and standards in place. *Daubert*, 509 U.S. at 593-94; *see Trala*, 162 F. Supp. 2d at 347, 350 (FBI's PCR/STR methodology has low to zero error rate, and controls are followed). As shown by the citations of cases and scientific authorities above, the PCR/STR method has gained extremely "widespread acceptance"—which is "an important factor" in reaching the conclusion that this is a method reliable enough to meet the standard for admissibility under *Daubert* and Rule 702. *Daubert*, 509 U.S. at 594. Based on

overwhelming scientific and forensic acceptance, as well as acceptance by the vast majority of courts, this Court concludes that the PCR/STR method of DNA typing is reliable and admissible under Rule 702 and *Daubert*.

D. Application of PCR/STR Methodology

1. Legal Standard

Defendant raises the issue of how intensively and extensively the trial court reviews proposed expert evidence in its gatekeeping function. The Government distinguishes between review of the methodology itself (i.e., the PCR/STR method of DNA testing), and review of the application of that methodology (e.g., the kits, software, hardware, and statistics). The Government's position is that once the PCR/STR methodology is held admissible under *Daubert* and Rule 702, challenges to the particular procedures and instrumentalities used in applying that method go primarily to the weight of the DNA evidence and not to admissibility. Defendant essentially argues that no distinction should be made between methodology and application, and that exactly the same analysis under *Daubert* applies to the PCR/STR methodology and to each part of the procedure. Defendant argues that, before DNA evidence can be admitted, the Government must prove that each step in the procedure and each item used in the procedure meet the *Daubert* test for scientific reliability. [Doc. No. 442, pp. 87-99]

The Court concludes that the caselaw, together with the policy and principles underlying Rule 702 and *Daubert*, supports the Government's position. As the Court concludes in Section IV(C) above, the PCR/STR methodology is reliable and admissible under Rule 702 and *Daubert*; Defendant's challenges to the application of that methodology go primarily to the weight of the DNA evidence, not its admissibility.

(a) Tenth Circuit caselaw

The Government states that the NMDPS Laboratory used: Quantifiler Duo DNA Quantification Kit; AmF1STR Identifiler PCR Amplification Kit; Applied Biosystems 7500 Real-Time PCR SDS Software, version 1.2.3.; Applied Biosystems 3130 Genetic Analyzer Data Collection Software, version 3.0; Applied Biosystems GeneMapper ID Software, version 3.2; FBI Popstats software, version 5.7.4; ABI Prism 3130 Genetic Analyzer. [Doc. No. 547, pp. 7-8] The Government states that the "systems and machines" used are "the industry standard for DNA testing." [Doc. No. 547, p. 4]

Defendant argues that "forensic DNA testing requires a series of distinct steps, and that the methods employed at *each major step* are independently reviewable under *Daubert*"; these "steps" and "methods" include all of the kits, software, and hardware listed in the preceding paragraph and, in addition, the statistical methods, population databases, and capillary electrophoresis. [Doc. No. 442, pp. 87, 90-91, 94-96] Defendant cites a number of Tenth Circuit cases—including *Dodge*, *Tyson Foods*, and *Davis*—in support of this argument. *Dodge v. Cotter Corp.*, 328 F.3d 1212 (10th Cir. 2003); *Att'y Gen. of Okla. v. Tyson Foods, Inc.*, 565 F.3d 769 (10th Cir. 2009); *United States v. Davis*, 40 F.3d 1069 (10th Cir. 1994). [Doc. No. 442, pp. 68, 87-90, 93-94, 97, 99; Doc. No. 562, pp. 7-8]

Defendant's argument relies heavily on language quoted by the Tenth Circuit in *Dodge*:

Under *Daubert*, "any step that renders the analysis unreliable . . . renders the expert's testimony inadmissible. This is true whether the step completely changes a reliable methodology or merely misapplies that methodology." *Mitchell*, 165 F.3d at 782 (quoting *In re Paoli R.R. Yard PCB Litig.*, 35 F.3d 717, 745 (3d Cir. 1994)). [hereinafter *Paoli II*]

Dodge, 328 F.3d at 1222; see *Tyson Foods*, 565 F.3d at 780 (quoting same language). [Doc. No. 442, p. 89] Relying on this "any step" language, Defendant argues that "the methods employed at *each major step* are independently reviewable under *Daubert*; each step must be scientifically

valid." [Doc. No. 442, p. 90] Defendant argues that several Tenth Circuit cases have addressed this issue and some have cited the "any step" language from *Paoli II*.

The Court concludes that this "any step" language does not mean what Defendant takes it to mean—that *Daubert* requires the same level of scrutiny for every step in the procedure as for review of the PCR/STR methodology itself. The Tenth Circuit cases cited by Defendant—*Dodge*, *Davis*, and *Tyson Foods*—do not support Defendant's argument.

Although *Dodge* quotes the "any step" language, that principle was not determinative in *Dodge* so it was unnecessary for the Tenth Circuit to extensively consider the point. *Dodge* acknowledges *Daubert*'s exhortation: "The focus, of course, must be solely on principles and methodology, not on the conclusions that they generate." *Daubert*, 509 U.S. at 595. *Dodge* then cites *Joiner*'s principle that there may be "simply too great an analytical gap between the data and the opinion proffered." *Joiner*, 522 U.S. at 146. [Doc. No. 442, pp. 88-89] *Dodge* finally cites the often quoted passage from the Third Circuit's opinion in *Paoli II*: "Under *Daubert*, "'any step that renders the analysis unreliable . . . renders the expert's testimony inadmissible. This is true whether the step completely changes a reliable methodology or merely misapplies that methodology.'" *Dodge*, 328 F.3d at 1222 (quoting *Mitchell v. Gencorp Inc.*, 165 F.3d 778, 782 (10th Cir. 1999) (quoting *Paoli II*, 35 F.3d at 745)). Although the *Dodge* court cited these propositions, the holding did not rest on clarifying or applying them. Instead, the Tenth Circuit reversed because the trial court had not performed its gatekeeping function—failing to make specific, detailed findings that the expert opinions were based on valid reasoning and reliable methodology. *Id.* at 1225-28. An additional and alternative ground for reversal was the trial court's unreasonable limitation of the information upon which it made its *Daubert* decisions. *Id.* at 1228-29. *Dodge* therefore does not aid Defendant.

Nor does the Tenth Circuit opinion in *Davis* support Defendant's argument. In *Davis*, the defendants argued that because the trial court did not adequately investigate whether the government had followed protocol, the government had not established the reliability of the RFLP DNA analysis. *Id.* at 1073. The *Davis* court stated the inquiry under *Daubert* as a two-part test: (1) "whether the reasoning or methodology underlying the testimony is scientifically valid," and (2) "whether that reasoning or methodology properly can be applied to the facts in issue." *Id.* at 1074 (quoting *Daubert*, 509 U.S. at 592-93). Only the second part was at issue in *Davis*. *Id.* at 1074, 1072 (at trial the parties, then proceeding under *Frye*, had stipulated RFLP DNA testing was "generally accepted"). The Tenth Circuit identified a split in the circuits. The Court suggested that the Eighth Circuit "concluded that *Daubert* has *raised* the standard" by requiring the trial court "to make a specific finding that 'the testimony was derived from the *application* of a reliable methodology'" before admitting scientific evidence. *Davis*, 40 F.3d at 1074 (quoting *Martinez*, 3 F.3d at 1198). In contrast, the Second and Ninth Circuits held that adherence to protocol was normally an issue for the jury and that imperfectly conducted laboratory procedures go to the weight of DNA evidence, not its admissibility. *Id.* at 1074 n.7 (citing *United States v. Jakobetz*, 955 F.2d 786, 793-800 (2d Cir. 1992); *United States v. Chischilly*, 30 F.3d 1144, 1154 (9th Cir. 1994)). The Tenth Circuit found it unnecessary to address this circuit split or to more intensively review what *Martinez* held; the trial court in *Davis* had determined that protocol was followed, thus meeting the highest standard discussed. *Davis*, 40 F.3d at 1075.

Davis does not aid Defendant. First, the Tenth Circuit did not hold that the "stringent" standard ascribed to *Martinez* was required by law—only that the trial court in *Davis* had in fact satisfied this standard. *Id.* at 1075. Second, the Tenth Circuit was critical of this "stringent"

standard, because raising the standard for expert evidence was contrary to *Daubert* and the "liberal thrust" of the Federal Rules. *Id.* at 1074.

In *Tyson Foods*, the State of Oklahoma asserted environmental claims and sought to enjoin Tyson Foods from applying poultry waste to land within the Illinois River Watershed. Oklahoma's expert used microbial source tracking to identify a DNA biomarker specific to poultry litter bacteria; by using PCR to replicate the bacteria's DNA, she believed she could identify whether the bacteria in various environmental samples came from poultry litter instead of from other sources. *Id.* at 775, 780. The process required the expert to identify and develop poultry-litter-specific DNA fragments, or primers, in an effort to track the source of contamination. *Id.* at 780-81.

Because the PCR methodology was applied to an entirely new area, requiring the development of primers for bacterial DNA that had not been identified previously, the district court looked to other indications of reliability for this "novel and untested" method. *Id.* at 781. Since there were no additional indications of reliability—no testing, no publications, no peer review—the district court determined that the expert evidence was not "sufficiently reliable" under *Daubert*. *Id.* at 775, 780-81. The Tenth Circuit affirmed, holding that "where established methods are employed in new ways, a district court may require further indications of reliability." *Id.*

At first blush, *Tyson Foods* may appear to support Defendant's argument. In setting out the legal standard, *Tyson Foods* does quote the "any step" language from *Paoli II*. *Id.* at 780 (quoting *Mitchell v. Gencorp Inc.*, 165 F.3d 778, 782 (10th Cir. 1999) (quoting *Paoli II*, 35 F.3d at 745)). The Tenth Circuit decided the case on the basis of *Joiner*, however—holding that there was "too great an analytical gap" when the expert applied established methodology in a novel

way, without "further indications of reliability." *Id.* at 780. In fact, *Tyson Foods* suggests that the "any step" language is a restatement of *Joiner*; a step that "completely changes a reliable methodology or merely misapplies that methodology" constitutes "too great an analytical gap." Interpreted in this way, *Tyson Foods* does not support Defendant's argument.

In addition, *Tyson Foods* provides some support for the Government's position. The Tenth Circuit hints that the PCR methodology is scientifically valid, and cites with approval several cases admitting PCR evidence and also holding that deficiencies in the procedure go to weight, not admissibility. *Id.* at 780-81. The Tenth Circuit cites *United States v. Boswell*, 270 F.3d 1200, 1205 (8th Cir. 2001), with the parenthetical "admitting PCR evidence . . . and indicating that 'deficiencies' [in the PCR procedure] go to the weight to be given the DNA evidence, not its admissibility." *Id.* The Tenth Circuit also cites its own unpublished opinion in *Stills v. Dorsey*, 7 Fed. Appx. 856, 859 (10th Cir. 2001), as "indicating that 'objections to the reliability of the PCR analysis go to the weight of the evidence rather than its admissibility.'" *Id.* at 781. This part of *Tyson Foods* provides some support for the Government's position that challenges to the application of a reliable methodology go to weight and not admissibility.

The Court has considered several additional Tenth Circuit cases which set forth the "any step" language.

Tyson Foods quoted an earlier Tenth Circuit opinion which quoted *Paoli II: Mitchell v. Gencorp Inc.*, 165 F.3d 778 (10th Cir. 1999). In *Mitchell*, the Tenth Circuit affirmed the exclusion of expert testimony in a toxic tort case. The plaintiffs' experts merely gave opinions that a different chemical than the defendant's chemicals causes a different type of leukemia than the decedent's leukemia; the experts' conclusions that the defendant's chemicals caused the decedent's type of leukemia therefore constituted unwarranted extrapolation. *Id.* at 781-83. The

Tenth Circuit stated that this opinion evidence was connected to the existing data only by the "*ipse dixit*" of the expert; therefore, there was "simply too great an analytical gap between the data and the opinions offered," under *Joiner*. 165 F.3d at 782; *Joiner*, 522 U.S. at 146. Although the *Mitchell* court did quote the "any step" language from *Paoli II*, the Tenth Circuit's decision in *Mitchell*—as in *Tyson Foods*—rested solidly on *Joiner*.

In *Cornwell*, the driver of an SUV had been killed when she hit a locomotive. *Cornwell v. Union Pac. R.R.*, 453 Fed. Appx. 829 (10th Cir. 2012) (unpublished). To determine whether the victim's view of the oncoming train was blocked, the expert and his assistant drove the same route while videotaping and photographing from a driver's perspective; however, they used a minivan instead of an SUV, and they speculated on the tracking of the victim's eyes as she approached the railroad crossing. *Id.* at 833. The district court excluded the proffered expert evidence, ruling that it was unreliable under *Daubert*. The Tenth Circuit affirmed, stating that the district court's ruling was supported by Tenth Circuit precedent and caselaw from other circuits; the cited cases affirmed exclusion of expert testimony because the experts conducted tests with a different truck, or reached a conclusion based on published material about the critical interior dimensions of a car instead of conducting an actual test inside the car. *Id.* These were the Tenth Circuit's examples to illustrate the principle that "'any step that renders the analysis unreliable renders the expert's testimony inadmissible.'" *Id.* (quoting *Tyson Foods*, 565 F.3d at 780). These cited cases, *Cornwell*, and *Tyson Foods*, illustrate that the Tenth Circuit interprets the "any step" principle to refer to the same type of deficient evidence described by *Joiner* as an "analytical gap."

The Court concludes that the Tenth Circuit cases, though they do not directly address the issue raised by Defendant, do not generally support Defendant's argument. Taken out of context,

the "any step" language may appear to do so, but close examination shows that the Tenth Circuit cases appear to view this as essentially a restatement of "too great an analytical gap" under *Joiner*. The *Joiner* issue—the lack of sufficient connection between the conclusions and data—is a different issue from the level of scrutiny for reviewing the application of a reliable methodology.

(b) Caselaw from other circuits

Since the Tenth Circuit cases cited do not directly address the issue, the Court looks to caselaw from other circuits. The "any step" language quoted by the Tenth Circuit in *Dodge* and *Tyson Foods* comes from a Third Circuit case, *Paoli II*; since the Tenth Circuit adopted this principle, it is important to see how the Third Circuit and other courts interpret it when addressing challenges to the application of DNA methodology.

Well-reasoned caselaw holds that a court should not review the application of a reliable methodology under the same *Daubert* analysis as the methodology itself. Review of the cases reveals a split, with the Third and Eighth Circuits taking a more conservative view and requiring some review of challenges to procedures before expert evidence is admitted—while many other cases hold that challenges to the application of a reliable methodology go to the weight of the expert evidence, not its admissibility. Neither side of the split supports Defendant's argument.

The Third Circuit, in an opinion issued in 1990, stated that if a "challenged procedure is more accurately described as an application of an accepted methodology," the challenge is a matter for resolution by the factfinder and goes to the weight of the evidence, not its admissibility; but if "the allegation is that a reliable methodology was so altered as to skew the methodology itself," the issue goes to admissibility of the evidence. *In re Paoli R.R. Yard PCB Litig.*, 916 F.2d 829, 858 (3d Cir. 1990) (emphasis added) [hereinafter *Paoli I*]. In 1994, based

on *Daubert*, the case was again before the Third Circuit. *In re Paoli R.R. Yard PCB Litig.*, 35 F.3d 717, 745 (3d Cir. 1994) [hereinafter *Paoli II*]. After *Daubert*, the Third Circuit believed that a clear-cut distinction between a methodology and its application was not viable. The *Paoli II* court stated that "*any step that renders the analysis unreliable under the Daubert factors renders the expert's testimony inadmissible. This is true whether the step completely changes a reliable methodology or merely misapplies that methodology.*"¹⁴" 35 F.3d at 745. This quotation, considered out of context, states a tautology: Unreliable evidence is inadmissible. The question remains what kind of step "renders the analysis unreliable" and renders the evidence inadmissible. *Paoli II* answers this question: only a major misstep justifies exclusion of evidence. Footnote 14 states: "Of course, if a court finds that an expert has employed a methodology only slightly different from a methodology that the court thinks is clearly reliable, the court should be more likely to accept the altered methodology than if it was evaluating that methodology as an original matter." 35 F.3d at 745 n.14. And the *Paoli II* court further limited the "any step" language by saying that evidence should not be excluded for a minor flaw in application:

Thus, as we explained above, we think that the primary limitation on the judge's admissibility determinations is that the judge should not exclude evidence simply because he or she thinks that there is a flaw in the expert's investigative process which renders the expert's conclusions incorrect. The judge should only exclude the evidence if the flaw is large enough that the expert lacks "good grounds" for his or her conclusions.

35 F.3d at 746. Careful consideration of the entire opinions shows that *Paoli I* and *Paoli II* are not so different as at first appears. Despite *Paoli II*'s statement that after *Daubert* the distinction between a methodology and its application is no longer viable, the import of the entire *Paoli II* opinion is still that a flaw in the procedures, or in the application of the methodology, does not

render the expert evidence inadmissible unless it is a major flaw which undermines the entire analysis.

In a later case, the Third Circuit explained and clarified *Paoli II*. The Third Circuit stated that in *Paoli II* it had "cautioned" that the standard for determining reliability "is not that high," and "is lower than the merits standard of correctness"; the grounds for an expert's opinion "merely have to be good"—not "perfect." *In re TMI Litig.*, 193 F.3d 613, 665 (3d Cir. 1999) (quoting *Paoli II*, 35 F.3d at 744-45). An expert opinion need not be "supported by the best methodology or unassailable research." *Id.* In applying the "any step" principle of *Paoli II*, the *TMI* court held that expert testimony was inadmissible because the expert admitted that an essential element of his analysis was correlation by additional studies; when the expert admitted that there had been no additional studies, this missing correlation rendered the methodology unreliable and the expert's opinion inadmissible. *Id.* at 694-95. This was an example of the principle that "any step" may render expert testimony inadmissible; omission of an essential element of an analysis was significant enough to "completely change" a reliable methodology or to "misapply" that methodology.

As the Second Circuit explained *Paoli II*, a "minor flaw in an expert's reasoning or a slight modification of an otherwise reliable method" does not render expert evidence inadmissible." *Amorgianos v. National R.R. Passenger Corp.*, 303 F.3d 256, 266-67 (2d Cir. 2002) (emphasis added). The expert evidence is inadmissible only if "the flaw is large enough that the expert lacks 'good grounds' for his or her conclusions." *Id.* at 267 (quoting *Paoli II*, 35 F.3d at 746).

The Eighth Circuit takes the same approach as the Third Circuit. In *Martinez*, the Eighth Circuit reconciled the two competing principles set forth by the *Daubert* Court: the need for the

trial court to ensure that scientific evidence is "not only relevant but reliable," and the need to respect the role of the jury in "the adversary system" under the more liberal *Daubert* standard for admissibility. *United States v. Martinez*, 3 F.3d 1191 (8th Cir. 1993) (quoting *Daubert*, 509 U.S. at 589, 596). If the application of the methodology is challenged, the trial court must determine whether any error in application "so infected the procedure as to make the results unreliable." *Id.* at 1198. An "alleged error in the application of a reliable methodology should provide the basis for exclusion of the opinion only if that error negates the basis for the reliability of the principle itself." *Id.* (emphasis added). The *Martinez* court stated that it agreed with the Third Circuit's approach in *Paoli I. Id.*

A later Eighth Circuit case applied *Martinez* in rejecting a challenge to PCR DNA evidence. The defendant in *Beasley* argued that PCR testing did not meet the standards of admissibility under *Daubert*, and that even if it did, the protocol and procedures employed by the Minnesota laboratory were inadequate. *United States v. Beasley*, 102 F.3d 1440, 1445, 1448 (8th Cir. 1996) (alleged inadequacies included infrequent proficiency testing, insufficient testing to check results and demonstrate compliance with proper procedures, failure to maintain records of errors). The Eighth Circuit held that the reliability of PCR DNA analysis was sufficiently well established for courts to take judicial notice of it in future cases. *Id.* at 1448. And because the defendant failed to show that the alleged deficiencies in the application of the PCR methodology would skew the methodology itself, the Eighth Circuit held that the challenges went to the weight of the DNA evidence, not its admissibility. *Id.* at 1448.

The Eighth Circuit again applied this approach when a defendant challenged the reliability of new kits for applying the PCR/STR methodology. *United States v. Gipson*, 383 F.3d 689, 696-97 (8th Cir. 2004). The challenge to the reliability of the Profiler Plus and Cofiler

kits was a challenge to the "*application* of a scientific methodology," and not a challenge to the reliability of the PCR/STR methodology itself. *Id.* All that was required, therefore, was a determination that the kits were not so unreliable that they materially altered the methodology itself.

Other courts follow this approach. *See, e.g., United States v. Morrow*, 374 F. Supp. 2d 51, 62 (D.D.C. 2005) (initial inquiry into expert's application of the scientific principle or methodology was required, but any error in applying protocols precludes admission only if "error so infected the procedure as to make the results unreliable," *Martinez*, 3 F.3d at 1198); *State v. Langill*, 945 A.2d 1, 9-10 (N.H. 2008) (even multiple flaws in expert's application of a methodology render evidence inadmissible only if they "contaminate the reliability of an expert's conclusions," so infecting "the procedure as to make the results unreliable" (quoting *Martinez*, 3 F.3d at 1198)).

These cases, including those of the Eighth and Third Circuit, require the trial court to undertake some review of the application of a reliable methodology, but only allow exclusion for a flaw so large as to undermine the reliability of the methodology itself. *See Langill*, 945 A.2d at 9 (discussing similar approach of Eighth and Third Circuits). This conservative approach places great emphasis on *Daubert's* language that the trial court must "ensure that any and all scientific testimony or evidence" is reliable.

Other cases take a more liberal approach to admission of expert evidence over challenges to the procedure, or application of the methodology—emphasizing the liberal thrust of the Federal Rules and the emphasis on the factfinder's role in assessing and weighing evidence. For instance, the First Circuit took the approach that "any flaws in [an expert's] application of an otherwise reliable methodology went to weight and credibility and not to admissibility." *United*

States v. Shea, 211 F.3d 658, 668 (1st Cir. 2000). The First Circuit stated, "Most circuits that have spoken have agreed with this approach, relying on the view that 'cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof' is the proper challenge to 'shaky but admissible evidence.'" *Id.* (quoting *Daubert*, 509 U.S. at 596) (citation omitted). The federal district court had earlier issued a widely cited and well-reasoned opinion in the same case. *United States v. Shea*, 957 F. Supp. 331 (D.N.H. 1997), *aff'd*, 159 F.3d 37 (1st Cir. 1998). The district court in *Shea* reasoned that Rule 702 required different treatment of a challenge to the methodology and a challenge to the application of that methodology:

Almost any challenge to an expert's conclusions can be redefined as a dispute over methods. However, Rule 702's reliability requirement distinguishes between a claim that an expert's methods are unsound and a claim that scientifically sound methods have been applied improperly in a particular case. A claim that scientific methods are unsound must be addressed initially by the trial judge, while a claim that scientifically sound methods have been applied improperly ordinarily should be left for the jury to resolve unless the alleged "error negates the basis for the reliability of the principle itself." *United States v. Martinez*, 3 F.3d 1191, 1198 (8th Cir. 1993).

Shea, 957 F. Supp. at 337. The defendant in *Shea* argued: that PCR analysis was not reliable for DNA mixtures, that the FBI's testing protocols could result in typing errors by specifying incorrect amplification and typing temperatures, that the government had not demonstrated that the FBI laboratory has an acceptably low error rate, and that there were deficiencies in the FBI's procedures for quality control and evidence handling. *Id.* at 338-40. The district court broadly stated that it was unnecessary to address the merits of these arguments, because challenges to application go to weight and not admissibility of the evidence. *Id.* at 340-41.

Other courts also hold that challenges to the application of a methodology go to the weight of the evidence, not its admissibility. *See, e.g., United States v. Jakobetz*, 955 F.2d 786, 800 (2d Cir. 1992); *United States v. Bonds*, 12 F.3d 540, 563 (6th Cir. 1993); *In re Scrap Metal*

Antitrust Litig., 527 F.3d 517, 530 (6th Cir. 2008); *United States v. Chischilly*, 30 F.3d 1144, 1154 (9th Cir. 1994); *United States v. Hicks*, 103 F.3d 837, 846 (9th Cir. 1996), *overruled on other grounds by United States v. W.R. Grace*, 526 F.3d 499 (9th Cir. 2008); *Quiet Technology DC-8, Inc. v. Hurel-Dubois UK Ltd.*, 326 F.3d 1333, 1344-46 (11th Cir. 2003); *Rosenfeld v. Oceania Cruises, Inc.*, 654 F.3d 1190, 1193-94 (11th Cir. 2011); *Trala*, 162 F. Supp. 2d at 349; *People v. Shreck*, 22 P.3d 68, 81 (Colo. 2001) (en banc). These courts emphasize that *Daubert* requires that factual determinations and flaws in application of generally reliable methodology are to be handled by cross-examination at trial and presentation of contrary evidence. *See, e.g., Jakobetz*, 955 F.2d at 800; *Quiet Technology DC-8, Inc.*, 326 F.3d at 1345.

(c) Other caselaw cited by Defendant

Additional cases cited by Defendant are not persuasive. [Doc. No. 442, pp. 87-97] Defendant's often cursory citations, many of them to *Frye* cases, do not support his argument. Defendant argues: "The focus on the specific methods and procedures used in the particular case is universal in *Daubert* and *Frye* litigation." [Doc. No. 442, p. 94] Defendant is incorrect in arguing that the same approach toward admissibility is followed by *Frye* and *Daubert* cases. *Frye* cases intentionally apply a philosophy directly contrary to *Daubert* and the "liberal thrust" of the Federal Rules, consciously setting a higher bar to admission of expert evidence. As discussed in *Daubert*, *Frye* cases set an "austere standard, absent from, and incompatible with, the Federal Rules of Evidence." *Daubert*, 509 U.S. at 589. In determining how courts determine admissibility and what standard must be met, *Frye* cases are not persuasive in federal court.⁷

⁷ Defendant often fails to identify the cases he cites as *Frye* cases. [Doc. No. 442, pp. 87-97] The following are unpersuasive because they apply *Frye*: *People v. Venegas*, 74 Cal. Rptr. 2d 262, 282, 284 (1998); *Murray v. State*, 692 So. 2d 157 (Fla. 1997); *State v. Schwartz*, 447 N.W.2d 422, 424-25 (Minn. 1989); *People v. Castro*, 545 N.Y.S.2d 985 (N.Y. Sup. Ct. 1989) (applying *Frye* and additional restrictive factors); *State v. Jackson*, 582 N.W.2d 317, 324-25 (Neb. 1998); *Commonwealth v. Blasioli*, 713 A.2d 1117, 1119 & n. 1 (Pa. 1998); *Commonwealth v. Vao Sok*, 683 N.E.2d 671, 678 (Mass. 1997) (applying *Frye* and, in part, *Daubert*), *overruled on other grounds*

Nor do the federal cases cited by Defendant support his argument.

Defendant cites *Shea*, *Hicks*, and *Chischilly*. [Doc. No. 442, p. 90] These federal cases are discussed above as examples of cases holding that challenges to the application of a methodology go to the weight of expert evidence, not its admissibility. These cases support a contrary approach to the one Defendant advocates.

Defendant relies on one statement in *Beasley*: "[T]he PCR method of DNA typing using the DQ alpha Amplitype test kit and the Polymarker test kit has achieved general acceptance within the forensic science community." *Beasley*, 102 F.3d at 1446. [Doc. No. 442, p. 95 (citing as page 1445 of *Beasley*)] But this quotation is from the trial court's conclusions; as discussed above, the Eighth Circuit opinion in *Beasley* does not support Defendant's argument.

Defendant cites a Fourth Circuit opinion affirming the exclusion of expert testimony from a state Fire Marshall that an electric blanket caused a fire—when the Fire Marshall failed to examine and utterly failed to exclude as causes of the fire a burning candle, a lamp, an extension cord, a wall outlet or its wiring. *Bryte v. American Household, Inc.*, 429 F.3d 469, 472-73, 476-78 (4th Cir. 2005). [Doc. No. 442, p. 88] The proposed expert testimony in *Bryte* was thus speculative in the extreme; in addition, exclusion was justified by lack of a sufficient factual basis.

Defendant cites the district court opinion in *United States v. Lowe*, 954 F. Supp. 401, 411 (D. Mass. 1996). [Doc. No. 442, p. 95] The defendant in *Lowe* argued that the use of chemiluminescence instead of autoradiography in the detection phase of RFLP analysis was unreliable under *Daubert*; the government responded that a "full-blown *Daubert* analysis" was not required. *Id.* The district court stated that it was not resolving this "semantic debate," and

by *Canavan's Case*, 733 N.E.2d 1042 (Mass. 2000); *State v. Harvey*, 699 A.2d 596, 621 (N.J. 1997).

was required to "conduct a threshold evaluation of the new protocol to ensure reliability." *Id.* at 412. The court stated: "While the protocol may not rise to the heights of a new scientific 'methodology,' the *Daubert* factors are helpful in determining its reliability." *Id.* *Lowe* suggests some support for Defendant's argument, but does not clearly support Defendant. The district court declined to determine whether chemiluminescence was a new methodology or merely a new protocol, merely determining that the evidence was admissible because it met the *Daubert* standard for reliability. *Id.* at 416.

Defendant cites a New Mexico District Court case, *Coronado-Cervantes*: "In the absence of clear directive from the Tenth Circuit, this Court finds that under *Daubert*'s second 'relevance' prong, compliance with standard protocol in applying the RFLP technique is essential and goes to admissibility, rather than merely to the weight of DNA evidence as urged by the government." *United States v. Coronado-Cervantes*, 912 F. Supp. 497, 500 (D.N.M. 1996). [Doc. No. 442, pp. 97, 100] The *Coronado-Cervantes* court had recognized that the Tenth Circuit in *Davis* "expressly declined to address the split in the circuits over whether compliance with protocol is an issue of admissibility or weight." *Id.* After stating that the court would conclude that compliance with standard protocol goes to admissibility, however, the *Coronado-Cervantes* court stated that the defendant did not challenge the FBI's compliance with standard protocol. *Id.* Thus the statement on which Defendant relies is dictum.

Defendant cites *Government of Virgin Islands v. Byers*, 941 F. Supp. 513 (D.V.I. 1996). [Doc. No. 442, p. 90] The district court in *Byers* upheld the admission of RFLP DNA evidence over the defendant's criticism that the FBI should have adopted NRC I's recommendation in 1992 to use the ceiling principle instead of the product rule in statistical calculations; the district

court held that the challenge goes mostly to the weight of the DNA evidence, not its admissibility. *Id.* at 524, 528. *Byers* does not support Defendant's argument.

Defendant cites *United States v. Gaines*, 979 F. Supp. 1429 (S.D. Fla. 1997). [Doc. No. 442, p. 90] The district court in *Gaines* held that PCR DNA testing results were admissible. *Id.* at 1441. In performing its analysis, the court did separately determine whether sample processing, match determination, and random match probability calculations met the requirements of *Daubert*. *Id.* at 1437. The decision may lend slight support to Defendant's argument, but the court did not reach a holding on the issues raised in Defendant's case.

Defendant also appears to assert that an elevated level of review ("extreme circumspection") is required in a capital case before the Court allows DNA evidence to be presented to the jury. [Doc. No. 442, pp. 30-31, 108, 145, 147] But Defendant does not provide relevant, persuasive authority to support this assertion. Defendant argues that juries may be overwhelmed by DNA evidence, which may "'assume a posture of mystic infallibility in the eyes of a jury,'" quoting *People v. Venegas*, 74 Cal. Rptr. 2d 262, 286 (1998) (quoting *People v. Kelly*, 130 Cal. Rptr. 144, 149 (1976)). [Doc. No. 442, p. 31] But *Venegas* is quoting the argument from *Kelly* about why the *Frye* test is appropriate; *Kelly* is the case setting forth California's adoption of the *Kelly/Frye* test for expert evidence. In the passage quoted from *Kelly*, the California court is explaining that the "primary advantage" of the *Frye* test "lies in its essentially conservative nature"; "*Frye* was deliberately intended to interpose a substantial obstacle to the unrestrained admission of evidence based upon new scientific principles." *Kelly*, 130 Cal. Rptr. at 149. These are, of course, the arguments explicitly rejected by the *Daubert* court. Defendant also quotes *Venegas*, 74 Cal. Rptr. 2d at 284, for the proposition that "DNA is different." [Doc. No. 442, p. 31] In this passage, the *Venegas* court was merely explaining that the *Kelly/Frye* test

is intended to prevent the jury from uncritically accepting scientific evidence that is "unusually difficult for laypersons to evaluate"; jurors can understand and evaluate many types of evidence, but "DNA evidence is different" and a prerequisite to its admission is technical testimony from experts to show that correct scientific procedures were followed. *Venegas*, 74 Cal. Rptr. 2d at 283-84.

In support of his general argument that a higher standard for admission of scientific evidence is required because this is a capital offense, Defendant cites *United States v. Green*, 405 F. Supp. 2d 104, 109 (D. Mass. 2005). [Doc. No. 442, pp. 93, 132] Defendant quotes the district court in *Green*: "[W]hen liberty hangs in the balance—and, in the case of the defendants facing the death penalty, life itself—the standards should be higher than were met in this case, and than have been imposed across the country." *Id.* at 109. Despite this statement, however, the *Green* court admitted the evidence at issue—because the court was confident that admission was in line with "precedents across the country" and that "any other decision will be rejected by appellate courts." *Id.* All the court in *Green* did was to state a personal reluctance to follow what it recognized as well-established precedent; *Green* does not support Defendant's argument that a higher standard for admission of scientific evidence applies in capital cases.

The Court concludes that Defendant has not demonstrated that a heightened standard of admissibility applies to this scientific evidence. "[A]pplication of the ordinary rules of evidence generally does not impermissibly infringe upon a capital defendant's constitutional rights," including the Eighth Amendment. *People v. Eubanks*, 266 P.3d 301, 328 (Cal. 2011) (internal quotation marks omitted).

The Court concludes that Defendant has not provided relevant and persuasive authority for his assertion that an elevated standard of review of DNA evidence is warranted here. *See*

Cahill v. American Family Mut. Ins. Co., 610 F.3d 1235, 1238-39 (10th Cir. 2010) (court will not address conclusory arguments unsupported by citation to relevant authority). In this case, as in every case, the Court carefully considers and reviews the parties' arguments about admissibility of evidence.

(d) Policy and principles underlying Rule 702 and Daubert

Defendant's argument requires the Court to determine the extent of its role as gatekeeper. An authoritative treatise recognizes and discusses this issue, observing that "the extent of the trial judge's gatekeeping function" is "[p]erhaps *Daubert's* most serious ambiguity." 29 Charles Alan Wright & Victor James Gold, *Federal Practice and Procedure* § 6266, at 287 (1997 & Supp. 2012). *Daubert* does state that "the trial judge must ensure that any and all scientific testimony or evidence admitted is not only relevant, but reliable." *Daubert*, 509 U.S. at 589. According to Wright, the broadest reading of *Daubert* is that all reliability issues are resolved by the gatekeeper-judge and go to the admissibility of the evidence—including challenges to the methodology itself and challenges to the application of the methodology. 29 Wright & Gold, *supra*, § 6266, at 288, 290. Defendant McCluskey does not cite Wright, but Defendant's argument takes this approach—what Wright characterizes as "the broadest reading of *Daubert*."

Despite *Daubert's* statement that the trial judge must ensure that any scientific evidence admitted is reliable, other language in *Daubert* shows that the Court intended the jury to resolve many reliability issues—including those considered under the *Frye* standard as too difficult or overwhelming for a jury. *Id.* at 288. The *Daubert* Court rejected the argument that "befuddled juries" would be "confounded by absurd and irrational pseudoscientific assertions." *Daubert*, 509 U.S. at 595-96. The Court stated that this argument reflected an "overly pessimistic [view] about the capabilities of the jury and of the adversary system generally." *Id.* at 596. And the

Daubert Court emphasized that it was the jury's role to decide the reliability of questionable scientific evidence: "Vigorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence." *Id.* Wright discusses and resolves this apparent conflict within *Daubert*. 29 Wright & Gold, § 6266, at 288-89.

Wright states that the "narrowest reading of *Daubert* is that it reaffirms in most cases the jury's traditional power to weigh expert testimony in light of challenges to its reliability." *Id.* at 289. Under this interpretation, the trial judge decides the scientific validity of underlying principles and methodology; once that validity is demonstrated, other reliability issues go to the weight—not the admissibility—of the evidence. *Id.* And the gatekeeping role may be further reduced because, as *Daubert* observed, judicial notice may be taken of the validity of well-established science. *Id.* (citing *Daubert*, 509 U.S. at 592 n.11).

Wright concludes that "the broadest reading of *Daubert*"—the one which Defendant McCluskey advocates—"should be rejected." *Id.* at 290. "[I]t is inconsistent with both policy and precedent to make the admissibility of all expert testimony depend upon a showing that the expert's testimony is completely reliable in every respect." *Id.* at 290-91. "Since *Daubert* does not explicitly take such a position, and nothing in the Evidence Rules compels it, it seems unlikely that the Court intended such a departure from past practice." *Id.* at 291. First, this broad interpretation conflicts with the policy of preserving the jury's traditional power to weigh evidence and determine credibility of witnesses. *Id.* at 263, 289. The other language quoted above from *Daubert* ("Vigorous cross-examination") strongly suggests that the jury is to decide many issues of reliability. Second, this broad interpretation would raise the bar for admission of expert testimony from the prior requirements under *Frye*—contrary to *Daubert's*

intention to liberalize admission of expert evidence. *Daubert*, 509 U.S. at 589 (recognizing the "liberal thrust" of the Rules and their "general approach of relaxing the traditional barriers" to expert evidence). Wright observes, "In overturning *Frye*, it is unlikely that the Court in *Daubert* sought to make the admission of scientific evidence harder." 29 Wright & Gold, *supra*, § 6266, at 291.

Wright generally favors the narrow reading of *Daubert*, citing the principle that "trial judges are gatekeepers, not armed guards." *Id.* § 6266, at 88 & n.79.2 (Supp. 2012) (citing *Ruiz-Troche v. Pepsi Cola*, 161 F.3d 77, 86 (1st Cir. 1998)). Another case cited by Wright emphasizes this point: "[T]rial judges acting as gatekeepers under *Daubert* must not assume 'the role of St. Peter at the gates of heaven, performing a searching inquiry into the depth of an expert witness's soul' and thereby usurp 'the ageless role of the jury' in evaluating witness credibility and weight of the evidence." *Id.* n.79.2 (quoting *Guild v. General Motors Corp.*, 53 F. Supp. 2d 363, 369-70 (W.D.N.Y. 1999) (quoting *McCulloch v. H.B. Fuller Co.*, 61 F.3d 1038, 1045 (2d Cir. 1995))).

The Court concludes that Defendant's position runs contrary to the policy and principles underlying Rule 702 and *Daubert*.

(e) Conclusion on standard for review of challenges to procedures

Based on review of the arguments, the caselaw, and Rule 702's policies, the Court rejects Defendant's argument that each part of the procedure and each item used in the procedure are subject to the same *Daubert* analysis for admissibility as the PCR/STR methodology. The Court concludes that well-reasoned caselaw supports a distinction between methodology and application of that methodology. If the Court were to scrutinize each procedure and each item used with the same intensity, and under the same standards, as the court reviews the

methodology itself, the court would run afoul of the philosophy and principles of *Daubert*—to respect the "liberal thrust" of the Federal Rules by "relaxing the traditional barriers to 'opinion' testimony." *Daubert*, 509 U.S. at 588. Under *Daubert*, the barriers to admission of expert testimony are to be lowered; under *Daubert* the jury is to take a greater role in making reliability determinations and assessing expert evidence.

As discussed above, the approach of the Eighth and Third Circuits is somewhat more restrictive than the approach of the First and other Circuits. In view of the challenges raised by Defendant in this case and discussed below, however, it is not necessary for this Court to choose between these two approaches. Even under the more conservative approach of the Third and Eighth Circuits, Defendant's challenges do not rise to the level of flaws that would undermine or skew the PCR/STR methodology itself.

2. NMDPS Laboratory Standards and Controls

The Government states that the NMDPS DNA Laboratory used the following in this case: Quantifiler Duo DNA Quantification Kit; AmF1STR Identifiler PCR Amplification Kit; Applied Biosystems 7500 Real-Time PCR SDS Software, version 1.2.3.; Applied Biosystems 3130 Genetic Analyzer Data Collection Software, version 3.0; Applied Biosystems GeneMapper ID Software, version 3.2; FBI Popstats software, version 5.7.4; ABI Prism 3130 Genetic Analyzer. [Doc. No. 547, pp. 7-8; Def's Ex. G6] The Government states that the systems and machines used are "the industry standard for DNA testing." [Doc. No. 547, p. 4]

The Government states that the NMDPS Laboratory follows the Quality Assurance Standards (QAS) originally issued in 1998 by the FBI Laboratory's DNA Advisory Board (DAB), and revised in 2007 and 2011 by the Scientific Working Group on DNA Analysis Methods (SWGDM). [Doc. No. 547, pp. 18, 22 (citing Defendant's Ex. K6 & L6)] The

NMDPS Laboratory is audited annually for compliance with these standards. [Doc. No. 547, p. 18 (citing Defendant's Ex. K6 & L6)] The NMDPS lab conducts an internal audit every other year, with an external audit by scientists from other DNA laboratories conducted in the intervening years. [Doc. No. 547, p. 18] "These assessments are a systematic examination, conducted pursuant to FBI guidelines, which audits the facilities and equipment, the training of staff, the laboratories' written operating and technical procedures, and the casework reports and supporting documentation." [Doc. No. 547, p. 18 (citing Def's Ex. K6 & L6)]

The Government states that the NMDPS Laboratory is accredited by the American Society of Crime Laboratory Directors Laboratory Accreditation Board (ASCLD/LAB), and was accredited at the time of testing. [Gov's Ex. 1 (6/25/12); Doc. No. 547, pp. 9, 19] "The accreditation process not only involves the audits, but also whether the laboratory demonstrates and maintains good lab practices including evidence-handling procedures and preservation of chain-of-custody." [Doc. No. 547, p. 19]

The NMDPS Laboratory participates in proficiency tests of its analysts' performance in DNA analysis procedures. [Doc. No. 547, p. 19] "The QAS, issued by the FBI and followed by the NMDPS Laboratory, requires that each DNA analyst undergo an external proficiency test at least twice a year." [Doc. No. 547, p. 19] All casework conducted by NMDPS Lab analyst, Carrie Davis, is reviewed and confirmed by a second analyst before a case report is released. [Doc. No. 547, p. 20 (citing Def's Ex. M6 (Chapter 15))] The Government states that, in addition to following the FBI's QAS, the NMDPS Lab has established rigorous standards for technical procedures and policies, undergoing proficiency testing, internal validation, and performance checks. [Doc. No. 547, pp. 22-23 (citing Def's Ex. K6 & L6)] In addition, the NMDPS Lab routinely conducts internal validations on the equipment, and reviews and adopts

standards suggested by SWGDAM and external literature. [Doc. No. 547, p. 23 (citing Gov's Ex. 2, 3, 7, 8, 9 (6/25/12))]

The Government confirms that all of these controls were followed in this case. [Doc. No. 547, p. 23] These controls and standards support the Court's conclusion that the PCR/STR testing employed by the NMDPS Lab meets the standard of reliability under Rule 702 and *Daubert*. See *Daubert*, 509 U.S. at 593-94 (existence and maintenance of standards controlling the technique's operation is a factor for court to consider).

3. Identifiler and Quantifiler kits

Defendant argues that the kits used by the NMDPS Laboratory, the Identifiler and Quantifiler Duo, are "unreliable" and "novel" parts of the "methodology," which must be shown to be reliable under *Daubert* before the Government's DNA evidence is admissible—or, that even if they are not part of the methodology, the kits must be reviewed and approved under the same *Daubert* analysis applicable to a methodology. [Doc. No. 442, pp. 31 n.10, 87-98, 167] Defendant claims that the Identifiler kit "employed technology and test procedures substantially different from previous DNA testing methods." [Doc. No. 442, p. 16] Defendant generally claims that the Quantifiler Duo kit is "unreliable," citing one study and also saying that the defense is unaware of whether some suggested steps to ensure accuracy were followed. [Doc. No. 442, pp. 45-52] Defendant claims that unless these particular kits are found reliable under the full *Daubert* analysis, the Government's DNA evidence is inadmissible.

Defendant argues that, although four cases "specifically upheld the admissibility of the Profiler Plus and/or Cofiler test kits . . . it is important to note that none of the cited cases addressed . . . the Quantifiler and Identifiler kits" which were used in this case. [Doc. No. 442, p. 96] In a footnote, Defendant observes that only one case, *Jackson*, addressed the admissibility

of the Identifiler kit. [Doc. No. 442, p. 96 n.53] *People v. Jackson*, 77 Cal. Rptr. 3d 474 (Cal. Ct. App. 2008).

The Government responds that the California case, *Jackson*, determined that the use of a new kit, the Identifiler, did not change the methodology but increased the accuracy and efficiency of the analysis. [Doc. No. 547, p. 35] The Government alternatively argues that the Identifiler and Quantifiler Duo kits have been sufficiently validated and shown to be reliable. [Doc. No. 547, pp. 36-40]

In assuming that only caselaw specifically addressing the Identifiler and Quantifiler Duo kits is relevant, Defendant assumes his conclusion: that this Court, in its gatekeeping role, must subject any procedure or instrumentality used in applying a methodology to the same *Daubert* analysis for admissibility as the methodology itself. But this Court has concluded that a challenge to the application of the methodology is treated differently than a challenge to the reliability of the methodology itself. Alternatively, Defendant is assuming that these kits are part of the methodology. The Court also finds that the Identifiler and Quantifiler Duo kits are not part of the methodology under *Daubert*, but are instead part of the procedures used in applying that methodology.

Under the legal standard adopted above, the Court concludes that Defendant's challenges to the Quantifiler Duo and Identifiler kits go to the weight of the DNA evidence, not its admissibility—unless the challenges would demonstrate such a major flaw that it would undermine or skew the PCR/STR methodology itself. The challenges Defendant makes do not rise to the level of undermining, or skewing, the PCR/STR methodology; Defendant's challenges therefore go to the weight and not the admissibility of the evidence, and are for the jury to assess and resolve.

Courts addressing the use of new amplification and quantification kits have focused, not on the relatively minor differences between each kit, but instead on their common function in the application of DNA analysis. In a frequently cited case, the district court of Delaware determined that "the Cofiler and Profiler materials kits do not represent a separate part of the typing process, but rather, simply contain materials for beginning the PCR process." *Trala*, 162 F. Supp. 2d at 346; see John M. Butler, *Short Tandem Repeat Typing Technologies Used in Human Identity Testing*, BioTechniques, Vol. 43, No. 4 (Oct. 2007) [Gov's Ex. 10 (6/25/12), pp. 1-2]. The *Trala* court concluded that challenges to the reliability of the particular type of kit used go to the weight of the evidence rather than its admissibility. *Trala*, 162 F. Supp. 2d at 346 (citing *People v. Shreck*, 22 P.3d 68, 81 (Colo. 2001)).

In *Shreck*, the DNA evidence was derived from a PCR/STR multiplex system—the Profiler Plus and Cofiler kits, which use "a combination sixplex and nineplex system." *Shreck*, 22 P.3d at 80. The Colorado Supreme Court concluded that multiplex testing is sufficiently reliable to be admissible under Colorado Rule 702 ("CRE 702," which is identical to Fed. R. Evid. 702). *Id.* The trial court had found that "triplexing," which is a form of multiplexing, is generally accepted, but held that the "sixplex" and "nineplex" systems used in the *Shreck* case were not sufficiently validated or reviewed to be admissible. *Id.* at 81. The Colorado Supreme Court specifically disapproved of the trial court's distinction between these different systems. *Id.* Citing *Daubert*, the Colorado Supreme Court stated, "Such a fine distinction is not required under CRE 702's liberal standard for admissibility." *Id.* Since a kit is simply one tool for carrying out the PCR/STR methodology, challenges to the reliability of any particular kit—like challenges to other procedures—go to the weight of the evidence, and not to its admissibility. *Shreck*, 22 P.3d at 80-82 (emphasis added); see also *United States v. Ewell*, 252 F. Supp. 2d 104,

111 (D.N.J. 2003) (Cofiler and Profiler kits "merely provide the materials necessary to perform the PCR amplification process, and thus, the kits need not independently meet the *Daubert* standard of admissibility"); *United States v. Williams*, 2008 WL 5382264, *15 (C.D. Cal. 2008) (unpublished; non-precedential) (holding court need not undergo *Daubert* analysis for reliability of a new PCR/STR test kit because the PCR/STR methodology remained the same when different kits were used which analyzed more loci than prior testing kits; in fact, kits analyzing more loci were more accurate). The Court notes that the *Shreck* court's analysis is in accordance with well-reasoned cases holding that challenges to procedure or application generally go to weight and not admissibility; the *Shreck* court cites *Hicks* and *Shea*, discussed in preceding sections of this Memorandum Opinion and Order.

The Eighth Circuit also held that a defendant's challenge to the kits used constituted "a challenge to the application of the STR methodology"—not a challenge to the methodology itself. *United States v. Gipson*, 383 F.3d 689, 697 (8th Cir. 2004) (emphasis added). As discussed in the preceding section, the Eighth Circuit applies a slightly more conservative approach to a challenge to procedures, holding that exclusion of evidence is warranted "only if the methodology was so altered [by a deficient application] as to skew the methodology itself." *Id.* at 697. The Eighth Circuit determined that the kits "certainly" were not so unreliable that their use resulted in a material alteration of the PCR/STR methodology. *Id.* This conclusion was easily reached, because the magistrate judge's conclusion went farther than necessary; the magistrate judge had concluded that the kits would even satisfy the *Daubert* reliability standard. *Id.* It is important to note that the Eighth Circuit did not require the kits to satisfy the *Daubert* standard; all that was required was a finding that the challenges to the new kits did not allege such a major flaw that it could skew the methodology itself. *Id.*

In addition, caselaw from jurisdictions applying the *Frye* test supports the conclusion that new kits do not constitute a change in methodology and are therefore not subject to the same analysis for admissibility as the methodology itself. *See People v. Jackson*, 77 Cal. Rptr. 3d 474, 479-82 (Cal. Ct. App. 2008) (holding Identifiler was "new and improved version" of same methodology as previous kits; therefore, Identifiler did not have to meet *Frye* "general acceptance" test); *see also People v. Hill*, 107 Cal. Rptr. 2d 110, 117-19 (Cal. Ct. App. 2001); *People v. Henderson*, 132 Cal. Rptr. 2d 255, 262 (Cal. Ct. App. 2003); *People v. Stevey*, 148 Cal. Rptr. 3d 1, 6-8, 14 (Cal. Ct. App. 2012). These cases hold that challenges to a new kit go to the weight of the DNA evidence, not its admissibility. *See also Lemour v. State*, 802 So. 2d 402, 407-08 (Fla. Dist. Ct. App. 2001); *State v. Whittey*, 821 A.2d 1086, 1092, 1095 (N.H. 2003); *State v. Russell*, 882 P.2d 747, 760-61, 768 (Wash. 1994); *State v. Gore*, 21 P.3d 262, 272-73 (Wash. 2001), *overruled on other grounds by State v. Hughes*, 110 P.3d 192 (Wash. 2005); *State v. Van Adams*, 984 P.2d 16, 26-27 (Ariz. 1999).

Defendant's Reply erroneously asserts that the Government cannot rely on a *Frye* case here for the same reason that the Government argues Defendant cannot rely on *Venegas* on other points—because *Jackson* and *Venegas* apply the *Frye* test instead of *Daubert*. [Doc. No. 562, p. 6]⁸ In Section D(1)(c), *supra*, the Court explained that Defendant's reliance on *Frye* cases was unpersuasive, because *Frye* cases intentionally and consciously choose to set a higher bar for admission of expert evidence than *Daubert* does; therefore, *Frye* cases are not relevant in determining the (minimum) standards of admissibility. But *Frye* cases are persuasive here on a

⁸ In addition, Defendant argues that the Government cannot rely on the California case, *Jackson*, because the Tenth Circuit explicitly rejected the approach followed there; Defendant relies on his argument that *Tyson Foods* obliterated the distinction between methodology and procedure. [Doc. No. 442, p. 96 n.53] As discussed above (Section IV(D)(1)), the Court disagrees with Defendant's characterization of *Tyson Foods* and believes that different legal standards apply to methodology, on the one hand, and procedures (or application of the methodology), on the other hand.

different point: the determination that new kits constitute minor changes in procedure, which are not subject to the same level of scrutiny as a new methodology.

The Court finds these opinions, particularly *Trala*, *Shreck*, and *Gipson*, well reasoned and persuasive. The Court concludes that Defendant's challenges to the Identifiler and Quantifiler Duo kits constitute challenges to procedure or application, rather than challenges to the PCR/STR methodology itself; the Court also concludes that these challenges do not rise to the level of alleging major flaws that would skew or undermine the PCR/STR methodology. Defendant's challenges therefore go to the weight of the DNA evidence, not to its admissibility.

Moreover, even if it were necessary for this Court to make a preliminary determination under *Daubert* of the scientific reliability of the Identifiler and Quantifiler Duo kits, the Court would find that there is sufficient evidence to support a finding of reliability. First, the Identifiler kit has been tested, subjected to peer review and analysis, and shown to have an acceptable error rate. *See Daubert*, 509 U.S. at 595 (factors for Rule 702 inquiry). The manufacturer, Applied Biosystems, performed developmental validation experiments according to TWGDAM guidelines. [Gov's Ex. 12 (6/25/12)] The Government states that the NMDPS Laboratory conducted internal validation. [Doc. No. 547, p. 36] The Government provided abstracts of a number of studies demonstrating external validations of the kits. [Doc. No. 547, pp. 36-37; Gov's Ex. 13 & 14 (6/25/12)] The Identifiler kit, after review and evaluation by a panel of FBI personnel, was approved and accepted for use by NDIS (National DNA Index System), which is part of CODIS (Combined DNA Index System). NDIS, *DNA Data Acceptance Standards: Operational Procedures* § 6.6, at p. 4 & Appendix A.3, p. 14 (2005) (listing in Appendix A.3 extensive criteria considered before approval), [www.nlada.org/forensics/for lib/Documents/1132070952.06/RF GN 13 NDIS Data Standard](http://www.nlada.org/forensics/for_lib/Documents/1132070952.06/RF_GN_13_NDIS_Data_Standard)

[s%252005_31_05.pdf](#) (last visited 1/28/13); CODIS & NDIS Fact Sheet (2012) (listing Identifiler as one of the most frequently used PCR kits accepted at NDIS), www.fbi.gov/about-us/lab/biometric-analysis/codis/codis-and-ndis-fact-sheet (last visited 1/28/13). These studies and the acceptance by CODIS also tend to support a finding of general acceptance, the fourth factor listed by *Daubert*. [See also Gov's Ex. 10 (6/25/12), p. 2 (Identifiler kit is "widely used," which tends to show wide acceptance)]

The Court would also find the Quantifiler Duo kit reliable, if a preliminary finding of reliability were required. The manufacturer, Applied Biosystems, performed developmental validation experiments according to SWGDAM guidelines and DNA Advisory Board Quality Assurance Standards. [Gov's Ex. 18 & 19 (6/25/12)] The Government asserts that internal validations were also conducted by laboratories. [Doc. No. 547, p. 38] These exhibits suggest that this kit has been sufficiently validated, reviewed and analyzed; validation suggests that the error rate is acceptable. Defendant generally claims that the quantification kit is "unreliable," citing a study and speculating that some suggested steps to ensure accuracy might not have been followed. [Doc. No. 442, pp. 45-52] The Court finds that such challenges go to the weight of the DNA evidence, not its admissibility, and are matters which Defendant can address at trial through cross-examination or presentation of contrary evidence.

In addition, the Government states that the systems used in this case are "the industry standard for DNA testing." [Doc. No. 547, p. 4] The existence and maintenance of standards in DNA testing, and use of kits which are "the industry standard" supports a finding of reliability; if the scientific community performing DNA analysis accepts these kits, that supports a finding by the Court that they are reliable enough for admission and assessment by the jury. See *Daubert*, 509 U.S. at 594 (existence and maintenance of standards is a reliability factor); *Shea*, 957 F.

Supp. at 338-39 (compliance with industry standards indicates reliability); *Shreck*, 22 P.3d at 80 (wide acceptance among scientists indicates reliability).

4. Other Procedures and Instrumentalities

The same principles discussed in the preceding sections apply to other parts of the DNA process. Challenges to the procedures or instrumentalities go to the weight of the DNA evidence, and not its admissibility—unless the challenges rise to the level of showing a major flaw that undermines or skews the PCR/STR methodology itself.

The Government states that the NMDPS Laboratory follows the FBI's DAB QAS, conducting its own internal validations and performance checks and running negative controls at every step in the testing. [Doc. No. 547, p. 39] The Government states that the "systems and machines" used are "the industry standard for DNA testing." [Doc. No. 547, p. 4] Compliance with standards controlling the technique's operation, which are accepted by the scientific community performing DNA analysis, supports the conclusion that the resulting DNA evidence is reliable enough for admission and assessment by the jury. *See Daubert*, 509 U.S. at 594 (factors); *Shea*, 957 F. Supp. at 338-39.

The Government provided some material to show reliability of the GeneMapper ID software, Version 3.2, and the Applied Biosystems 3130 Genetic Analyzer; these exhibits show validation by the manufacturer. [Gov's Ex. 21-22 (6/25/12)] Government's Exhibit 23 indicates that the 3130 Genetic Analyzer was shown to produce "reliable and reproducible results" through validation studies designed in accordance with SWGDAM guidelines. [Gov's Ex. 23 (6/25/12), p. 1]

The Government states that the NMDPS Laboratory validates the use and performance of its laboratory automation feature, the Maxwell 16 Robot/Liquid Handler Operation, following

SOP. [Doc. No. 547, p. 39] Defendant refers to an external audit stating that these robotic instruments had no preventive maintenance in 2010; a memo states that since funding for service contracts was in question and the FBI QAS does not require preventative maintenance, the SOP was changed to state annual preventative maintenance as a goal rather than a requirement. [Doc. No. 442, pp. 40-41] Defendant makes no specific challenge to the operation of this robotic system, however, and the Government states that SOP requires controls and checks each time the robot is used. [Doc. No. 547, p. 39]

Capillary electrophoresis, the procedure used to analyze the amplified DNA fragments, has been found to be "generally accepted" in the scientific community, under the *Frye* test. *Jackson*, 77 Cal. Rptr. 3d at 481. A procedure meeting the more austere *Frye* standard necessarily meets the more liberal standards of Rule 702 and *Daubert*. The Utah Supreme Court observed that scientific literature appeared to be "unanimous in its approval of the general principle of identifying STRs by capillary electrophoresis," and took judicial notice of the "inherent reliability of the instrumentation used to effectuate the PCR STR DNA testing" in that case. *Butterfield*, 27 P.3d at 1144-45. Although the Court concludes that capillary electrophoresis, like each other procedure and instrumentality, need not meet the same reliability test as the methodology, the Court observes that "general acceptance" goes far toward meeting this more demanding standard.

Defendant makes some conclusory, general challenges—a number of which concern procedures and instrumentalities not used in this case. [E.g., Doc. No. 442, pp. 172-73]

The Court need not further address Defendant's challenges to the procedures and methods used, because all of the deficiencies alleged by Defendant, even if substantiated, would go to the weight of the DNA evidence, not to its admissibility. *See Beasley*, 102 F.3d at 1448. As in

Beasley, Defendant's arguments fail to show that the Laboratory's alleged deficiencies would so alter the PCR methodology as to skew or undermine the methodology itself; therefore, these arguments would not make the DNA test results inadmissible. *Id.*

Even if more were required here, the Court would still find that Defendant's challenges go to weight rather than admissibility. The NMDPS Laboratory performs validation and checking, and follows general controls and standards. The Court finds that the existence and maintenance of standards controlling the steps in the analysis constitute a factor in favor of the reliability of the NMDPS Laboratory's DNA analysis. Other courts have found this an important additional factor in favor of admissibility, when it is required under *Daubert* that reliability be demonstrated. *See Daubert*, 509 U.S. at 594; *Paoli II*, 35 F.3d at 742; *Trala*, 162 F. Supp. 2d at 345.

Defendant can make these challenges at trial. To the extent that scattered suggestions of problems are contained in Defendant's Memorandum and Reply, the Court finds that these are generally conclusory and speculative, without persuasive citation to authority. *See Cahill*, 610 F.3d at 1238-39 (court need not address conclusory arguments without citation to relevant authority); *Arizona Pub. Serv. Co.*, 562 F.3d at 1130 (same).

5. Contamination Controls

Defendant suggests that there may have been contamination, argues that there must be procedures to prevent and detect contamination, and generally argues that more stringent procedures could be followed and were not in this case. [Doc. No. 442, pp. 55-59, 67, 81, 151-63] Defendant does acknowledge: "The NMDPS has detailed procedures in its SOP for setting up and conducting PCR amplification and for protecting against the ever present danger of contamination." [Doc. No. 442, p. 59] Defendant then states that it is not possible to tell

whether these procedures were followed from the documentation provided and suggests that a pretrial evidentiary hearing is required to find out. [Doc. No. 442, p. 59] Defendant implies, without any supporting authority, that contamination is a greater problem with the Identifiler kit. [Doc. No. 442, p. 101] Defendant also asserts that he has demonstrated in his memorandum that "stringent contamination and other safeguards for this testing advocated by its proponents" have not been followed. [Doc. No. 442, pp. 101-02] Defendant also suggests the possibility of human error—for instance, mislabeling of samples. [Doc. No. 442, p. 67, 81]

The Government states that Davis collected and supervised collection of DNA evidence in this case, and that the NMDPS Laboratory sets standards for evidence collection and proper storage during analysis within its Quality Assurance Manual. [Doc. No. 547, p. 31 (citing Def's Ex. J6)] "The NMDPS Laboratory specifically follows the FBI's QAS." [Doc. No. 547, p. 33] The NMDPS Laboratory "follows a documented evidence/database sample control system to ensure the integrity of physical evidence and database samples," including well-documented chain-of-custody tracking. [Doc. No. 547, p. 32] Measures to control contamination include lab coats, gloves, and face masks; analysts take only the amount of sample needed; laboratory access is restricted. [Doc. No. 547, pp. 32-33] In addition, "[n]egative controls are run with each test, which shows if contamination is present." [Doc. No. 547, p. 33.] And the Government states that no "corrective actions were noted in this case," indicating that the controls were applied and showed that there was no contamination. [Doc. No. 547, p. 33 n.36]

The Government asserts that all of these conditions, controls, and procedures were followed in this case. [Doc. No. 547, p. 33] The Government argues that Defendant cites no support for his assertion that proper procedures were not followed. [Doc. No. 547, p. 32 n.34]

The Government also argues that any deficiencies as to controls, procedure, or chain of custody go to the weight and not the admissibility of the DNA evidence. [Doc. No. 547, p. 33]

The Ninth Circuit addressed challenges similar to Defendant's in *United States v. Hicks*, 103 F.3d 837, 846 (9th Cir. 1996), *overruled on other grounds by United States v. W.R. Grace*, 526 F.3d 499 (9th Cir. 2008). In *Hicks*, the defendant challenged the reliability of the PCR DNA testing method, arguing that PCR testing is particularly susceptible to contamination. *Id.* The Ninth Circuit rejected the defendant's challenges, holding that they go to the weight of DNA evidence, not its admissibility:

"Those concerns may arise with respect to any forensic evidence. The potential for contamination may present an open field for cross-examination or may be addressed through the testimony of defense experts at trial, as is true with other forensic evidence. However, it does not mean that the PCR method itself is inappropriate for forensic use. The possibility of human error does not prevent scientists from relying on scientific analysis if safeguards against such errors exist and are followed. Courts do not require that scientific tests be infallible to be admissible."

Hicks, 103 F.3d at 846 (quoting *State v. Lyons*, 924 P.2d 802, 813 (Or. 1996)). The Ninth Circuit reaffirmed its holding in *Chischilly* that the "'impact of imperfectly conducted laboratory procedures' is better approached 'as an issue going not to the admissibility, but to the weight of the DNA profiling evidence.'" 103 F.3d at 846 (quoting *Chischilly*, 30 F.3d at 1154). Allegations of possible contamination are matters affecting the weight of the evidence, not its admissibility. *Id.*

In another case, the Eighth Circuit upheld the trial court's ruling that challenges to the PCR method based on potential contamination go to weight and not admissibility; the Eighth Circuit held that the defendant failed to show that these alleged deficiencies "so altered the PCR methodology as to make the test results inadmissible." *Beasley*, 102 F.3d at 1447-48. The *Beasley* court reaffirmed the Eighth Circuit's approach that an "'allegation of failure to properly

apply a scientific principle should provide the basis for exclusion of an expert opinion only if a reliable methodology was so altered . . . as to skew the methodology itself." *Id.* at 1448 (quoting *Martinez*, 3 F.3d at 1198) (internal quotation marks omitted). Thus even under the more restrictive approach of the Eighth Circuit, allegations of contamination do not rise to the level of precluding admission of DNA evidence.

It is important that the testing laboratory employ procedures to avoid contamination. *Hicks*, 103 F.3d at 846; *see Daubert*, 509 U.S. at 594 (factors to consider may include existence of standards and controls); *Kumho Tire*, 526 U.S. at 149-50 (same). In *Trala*, the government showed that the laboratory protocol contained substantial controls and procedures for preventing contamination during the PCR/STR testing; since steps had been taken to prevent contamination, the *Trala* court held that the defendant's "vague, broad assertion" that there could have been contamination did not warrant exclusion of the DNA evidence. *Trala*, 162 F. Supp. 2d at 349. Similarly, a Massachusetts court applying *Daubert* observed that the laboratory followed many controls and safeguards to prevent contamination, and followed the standards of the DNA advisory board (and TWGDAM guidelines where not superseded); the court held that challenges based on the possibility of contamination went to the weight of the DNA evidence, not its admissibility. *Commonwealth v. Gaynor*, 820 N.E.2d 233, 251 (Mass. 2005).

The Court concludes that Defendant's vague, speculative suggestions that there may have been contamination or mislabeling are matters going to the weight of the DNA evidence, not its admissibility. The NMDPS Laboratory observes substantial controls and procedures to prevent contamination and similar problems, which is an important factor according to the caselaw.

In a footnote, Defendant suggests that there may be reports of incidents of DNA contamination in the NMDPS Laboratory, which he has not received; Defendant states that he

"hereby moves for disclosure of any such reports under *Brady*." [Doc. No. 442, p. 83 n.49] If this is an issue Defendant wishes to pursue, the Court advises that he should file a motion, under the appropriate procedure.

6. Chain of Custody

Defendant makes general assertions that the chain of custody is important and must be shown. [Doc. No. 442, pp. 151-54]

The Government responds that the NMDPS Laboratory sets forth documentation of evidence and proper storage within its Quality Assurance Manual, and that the Laboratory specifically follows FBI QAS. [Doc. No. 547, pp. 31-33 (citing Def's Ex. J6)]

The Government is correct that any deficiencies in the chain of custody go to the weight of the evidence, not its admissibility. [Doc. No. 547, p. 33] The Tenth Circuit has observed that the "chain of custody need not be perfect for the evidence to be admissible." *United States v. Yeley-Davis*, 632 F.3d 673, 683 (10th Cir. 2011) (internal quotation marks omitted); *see United States v. Moore*, 425 F.3d 1061, 1071 (7th Cir. 2005) (considering expert testimony of forensic chemist under *Daubert* and holding perfect chain of custody for drugs analyzed not necessary for admissibility; gaps in chain go to weight). If the chain of custody is imperfect, deficiencies go to the weight of the evidence, not its admissibility. *Yeley-Davis*, 632 F.3d at 683; *United States v. Vallie*, 284 F.3d 917, 920 (8th Cir. 2002). It is the role of the jury, then, to evaluate any defects in the chain of custody and to decide whether to accept or disregard the evidence. *Yeley-Davis*, 632 F.3d at 683

7. Mixtures and Analysis

Defendant suggests the possibility of problems with the guidelines for interpreting mixtures. [Doc. No. 442, p. 84-85]

The Government states that the NMDPS Laboratory has "conducted studies to define the limitations of the typing system and to examine the peak height ratios, and range of stutter percentages for each allele of each locus in forming its SOP." [Doc. No. 547, p. 23] When a mixture DNA profile is detected, the NMDPS SOP requires careful examination to determine whether there are two or more individuals within the profile, and, if so, whether a major and minor contributor can be determined. [Doc. No. 547, pp. 23-24] "The testing methods or the procedure itself does not change when it is a mixed sample, rather it is the identification of alleles which allows the analyst to conclude that a sample is mixed." [*Id.* p. 24] "Thus, the presence of a mixed DNA sample is a conclusion, not an input that requires a different type of testing or specialized expertise." [*Id.*]

The NMDPS SOP requires that inclusions in mixtures be described conservatively, using the language "cannot be eliminated" rather than "included"; similarly, when a mixture contains a secondary standard, as in this case, the language used is "consistent with" instead of a source attribution. [Doc. No. 547, pp. 26-27] Thus, in dealing with the secondary standards from Gary and Linda Haas, because it was not possible to obtain a known standard from their cremains, Davis's report uses the language "consistent with" in describing the relationship between the secondary standards and an evidence sample. [Doc. No. 547, p. 27]

The Government states that the NMDPS Laboratory's SOP "discusses mixtures in some depth," and tracks the SWGDAM recommendations for testing and interpreting mixture samples. [Doc. No. 547, p. 26] The NMDPS Laboratory follows the 2010 suggestions of the SWGDAM Mixture Committee. [Doc. No. 547, p. 26]

As the Government observes, citing studies, mixtures are routinely found and analyzed in forensic science; this is not a novel issue in DNA analysis. [Doc. No. 547, p. 24] *See Whitley*,

821 A.2d at 1096. Observing that the laboratory had protocols in place to control for flaws and guidelines for interpretation when analyzing mixed samples, the district court in *Trala* held that challenges to analysis of mixed samples go to the weight of the evidence and not its admissibility. *Trala*, 162 F. Supp. 2d at 349. Even under the elevated *Frye* standard, the court in *Whitney* held that issues in interpreting mixed samples affect the weight of the evidence, not the admissibility, and are matters for cross-examination. *Whitney*, 821 A.2d at 1096. (As discussed previously, when a court holds that evidence is admissible under the restrictive *Frye* test and an issue goes to weight only, that holding is persuasive that the evidence should be admissible under the liberal *Daubert* standard with the challenged issue also going to weight and not admissibility.)

The Court concludes that Defendant's challenges go to the weight and not the admissibility of the DNA evidence—with the exception of mixtures which constitute LCN testing, as discussed in Section (D)(4)(E) below. The Court finds that it is important that the NMDPS Laboratory has standards and protocols in place and follows SWGDAM recommendations. *See Daubert*, 509 U.S. at 594; *Kumho Tire*, 526 U.S. at 149-50. The existence and maintenance of standards is a factor in favor of admissibility. *See Paoli II*, 35 F.3d at 742; *Trala*, 162 F. Supp. 2d at 349. In addition, the Court believes that Defendant's challenges to the interpretation of mixed samples concern the expert's conclusions rather than methodology, and to that extent these challenges are not bases for exclusion. *See Daubert*, 509 U.S. at 595.

Defendant also asserts that the analyst failed to follow NMDPS Laboratory SOP when she typed and interpreted evidentiary samples after the known samples from decedents and defendants. [Doc. No. 442, pp. 63-65, 41-42] The Government responds, however, that the

NMDPS Laboratory follows the SWGDAM suggestion, requiring that, "to the extent possible, DNA typing results from evidentiary samples are interpreted before comparison with any known samples, other than those of assumed contributors." [Doc. No. 547, p. 26]

Defendant asserts that there was a "biasing effect" when the analyst knew the DNA profiles of the decedents and suspects before she analyzed many of the evidence samples. [Doc. No. 442, p. 71] The Government responds that analysts often have known standards before analyzing evidence, and that the process of comparing known standards to the evidence "is a reliable method in DNA analysis." [Doc. No. 547, p. 34 (citing Butler, *Advanced Topics* 2)] The Government also states that the "actual DNA testing of the samples gathered in evidence in this case was completed before consideration of the known samples," and that this is in accordance with SOP. [Doc. No. 547, p. 34 n.37 (emphasis added)] This procedure would appear to counter Defendant's assertion that the analyst "knew the DNA profiles of the decedents and suspects before" she analyzed evidence samples. The Court concludes that this issue is a subject on which Defendant can cross-examine the Government's expert or present his own evidence; this issue goes to the weight and not the admissibility of the DNA evidence.

8. Statistics

(a) Statistics and qualitative terms

Defendant argues that DNA evidence cannot be admitted without statistical data, and also objects to testimony that Defendant is "the source" of any DNA. [Doc. No. 442, pp. 108-33, 167] Defendant also argues that statistical data "must be generally accepted within the scientific community pursuant to *Frye v. United States* as accurately expressing the statistical significance of the match." [Doc. No. 442, p. 114] Defendant again relies on the *Frye* test, which is inapplicable in federal court.

Defendant argues that, unless statistical calculations are included, testimony is inadmissible if it uses only qualitative terms—i.e., that a DNA profile is "consistent with" a sample, or that a person "cannot be eliminated" as a contributor to the sample; Defendant argues that these terms cannot be understood and evaluated "without statistics." [Doc. No. 442, pp. 110-19] The Government states that the NMDPS Laboratory's SOP establishes the language to be used regarding mixtures, and that the language used is conservative (e.g., "cannot be eliminated" rather than "included"). [Doc. No. 547, p. 26] In his Supplemental Memorandum, Defendant states that "no statistical estimates have been made with respect to many samples in this case." [Doc. No. 442, pp. 116, 25] The Government responds that statistics have been included—in the reports or in the case notes, which were provided to Defendant (but not all of which were provided, in their entirety, to this Court); in addition, Davis amended her report to include statistics for conclusions that a sample was "consistent with" Gary Haas or Linda Haas. [Doc. No. 547, p. 25 n.27] In addition, the Government's Response includes statistics for source attributions made to Defendant on Items 1B22A, 1B22B, 1B22C, and 1B39A. [Doc. No. 547, p. 48] Defendant's Reply does not reassert that random match probabilities have not been provided. It appears that there is no issue to resolve here; the parties appear to be in agreement that statistical calculations can and will be provided at trial in addition to qualitative terms.

The Government states that the NMDPS Laboratory follows the recommendations of NRC II. [Doc. No. 547, pp. 50-52] NRC II explicitly endorses use of the "product rule" to determine the probability of finding a similar match if a DNA sample were drawn randomly from the population. NRC II, at pp. 5, 122; *see Whittey*, 821 A.2d at 1097 ("product rule" meets restrictive *Frye* test; any alleged misapplication would go to weight, not admissibility under *Frye*). Under the product rule, the probabilities of each of the genotypes are multiplied together

to obtain the random match probability. The Government states that the NMDPS Laboratory uses the FBI CODIS Popstats program, using the FBI's Identifiler STR database and the American Indian STR database. [Doc. No. 547, p. 51] The Government related that the NMDPS Laboratory follows strict quality assurance standards, that the Lab undergoes internal and external audits for compliance with standards, is accredited by the American Society of Crime Laboratory Directors Laboratory Accreditation Board, participates in proficiency tests, and follows FBI CODIS standards. [Doc. No. 547, pp. 17-20, 51-52; Doc. No. 442, p. 74 (Defendant agrees NMDPS Laboratory was accredited at time it performed analysis and wrote reports in this case)]

The statistics are offered to help the jury evaluate the significance of the DNA evidence. The Court finds that Defendant's challenges go to the weight of the DNA evidence, not its admissibility. First, some of these challenges are in the nature of challenges to the expert's conclusions, and therefore not to be considered as bases for exclusion. *Daubert*, 509 U.S. at 595 (proper focus is on principles and methodology, not conclusions). Second, Defendant's challenges are to the application of the principles, and do not approach the level of altering a reliable methodology to the extent of "skew[ing] the methodology itself"; therefore, these alleged deficiencies would go to the weight of the evidence and not to its admissibility. *Beasley*, 102 F.3d at 1448. Defendant's arguments present issues for the jury to resolve. Third, even courts applying the heightened standard of *Frye* have held that challenges to statistical calculations and results go to weight, not admissibility. *See, e.g., Whittey*, 821 A.2d at 1097 (even misapplication of product rule would go to weight, not admissibility); *State v. Kinder*, 942 S.W.2d 313, 327 (Mo. 1996) (criticisms of statistical methods go to weight, not admissibility); *State v. Faulkner*, 103 S.W.3d 346, 359-60 (Mo. Ct. App. 2003) (any criticism of particular

statistical methods goes to weight only, and is for jury to decide); *see also Bonds*, 12 F.3d at 564-65 (under *Daubert*, challenges to statistics and probability results go to weight, not admissibility). In addition, and alternatively, the Court finds that the Government has provided adequate information to show that its statistics are grounded in reliable principles and are admissible for that reason.

The Court finds that use of qualitative terms, along with statistics, is relevant, admissible, and will assist the jury in understanding the DNA evidence. *See* Fed. R. Evid. 401; Fed. R. Evid. 402; Fed. R. Evid. 702. In addition, the Court finds that the probative value of these qualitative terms, along with statistical calculations, is not substantially outweighed by any prejudicial effect. *See* Fed. R. Evid. 403.

(b) Source attribution

Defendant argues strenuously that the Court should preclude evidence that Defendant is the "source" or the "sole source" of DNA evidence, "to the exclusion of all other people in the world." [Doc. No. 442, pp. 23, 119, 133] Defendant overstates the evidence the Government apparently intends to present. The laboratory reports conclude: "To a reasonable degree of scientific certainty, John McCluskey is the source of the major DNA profile resolved from these mixtures." [Def's Ex. G6, Sept. 30, 2010 lab report (emphasis added)] This is a significantly different opinion than in Defendant's overstatement.

Defendant cites a number of cases involving ballistics testimony. These cases might support Defendant's argument if Defendant's characterization of the expert's testimony were not an overstatement. These cases, however, approved language generally equivalent to the language of the Government expert's laboratory reports, and do not, therefore support Defendant's argument in this case. Thus Defendant cites *Green*, but the language excluded in

Green was substantially more absolute than the language of the Government's laboratory reports in this case. See *United States v. Green*, 405 F. Supp. 2d 104, 108-09 (D. Mass 2005) ("I will not allow him to conclude that the shell casings come from a specific pistol 'to the exclusion of every other firearm in the world.'" (footnote omitted)). Similarly, the other cases cited by Defendant concerned much stronger and more absolute language. See *United States v. Willock*, 696 F. Supp. 2d 536, 574 (D. Md. 2010) (recommending disallowance of expert testimony that it is "a practical impossibility" for any other firearm to have fired the cartridges, and alternatively recommending language "more likely than not" or "to a reasonable degree of ballistic certainty"); *United States v. Taylor*, 663 F. Supp. 2d 1170, 1179-80 (D.N.M. 2009) (expert precluded from testifying to match as a matter of scientific certainty, but allowed to testify bullet came from suspect rifle "within a reasonable degree of certainty in the firearms examination field"); *United States v. Glynn*, 578 F. Supp. 2d 567, 570-75 (S.D.N.Y. 2008) (based on court's view of limited nature of ballistics expertise, expert allowed to testify "more likely than not" to match to gun); *United States v. Diaz*, 2007 WL 485967, *11 (N.D. Cal. 2007) (unpublished) (expert allowed to testify "to a reasonable degree of ballistic certainty"); *United States v. Monteiro*, 407 F. Supp. 2d 351, 372 (D. Mass. 2006) (experts not allowed to testify they were 100% sure of a match, but allowed to testify "to a reasonable degree of ballistic certainty").

The cases cited by Defendant, discussed in the preceding paragraph, support admission of the type of language related in the Government's laboratory reports: "To a reasonable degree of scientific certainty, John McCluskey is the source of the major DNA profile resolved from these mixtures." [Def's Ex. G6, Sept. 30, 2010 report, p. 2 (emphasis added)]

Defendant cites a number of authorities and laboratories that reject the use of source attribution. [Doc. No. 442, pp. 121-32] Defendant submitted an affidavit from Dr. Laurence D.

Mueller, Ph.D., giving his opinion that a source attribution "is not based upon sufficient facts or data and is not the product of reliable scientific principles" and is not "the consensus" of the scientific community. [Def's Ex. Y6, pp. 3, 6] Dr. Mueller, however, acknowledges that NRC II takes the opposite view. [*Id.* pp. 5-6] *See* NRC II, p. 195. Perhaps Dr. Mueller is expressing the view that under *Frye*—which is still followed in California—source attribution does not meet the *Frye* test of "general acceptance"; Dr. Mueller's statement that this is not "the consensus" suggests that conclusion. The Court observes that, in federal court, "consensus" and "general acceptance" is not the standard. In addition, part of the basis for Dr. Mueller's opinion is the potential for laboratory error—another issue on which Dr. Mueller disagrees with NRC II. [Def's Ex. Y6, p. 5] *See* NRC II, p. 87.

The Government cites authority for allowing a source attribution, stating that the FBI adopted a policy in 2000 of using source attribution. [Doc. No. 547, p. 46] The Government states that some prominent scientists approve source attribution. The Government also states that the NMDPS Laboratory follows the NRC II guidelines. [Doc. No. 547, p. 47 & n.52, pp. 51-52] The Government states that SWGDAM guidelines allow a laboratory to use source attribution statements, provided that the laboratory has established guidelines, and that the NMDPS Laboratory has established guidelines based on NRC II and the FBI protocol—allowing a source attribution when the random match probability is 1 in 260 billion or less. [Doc. No. 547, p. 49-50] The Government states that it has provided statistical information to Defendant within the case notes; the Government's Response lists statistical frequencies for Items 1B22A, 1B22B, 1B22C, 1B39A—ranging from 1 in 653.6 quintillion to 1 in 4.878 quintillion. [Doc. No. 547, p. 48]

Some courts have held that a "source attribution" is admissible without presentation of the random match probability figure or other statistical calculation. A federal district court in Maryland, relying on NRC II and on an opinion from the highest state court of Maryland, held that there is no scientific basis for requiring statistics when the random match probability is "sufficiently infinitesimal" that the profile can be considered unique (absent identical twins, or maybe close relatives). *United States v. Davis*, 602 F. Supp. 2d 658, 683 (D. Md. 2009). The *Davis* court was persuaded by the reasoning of the Maryland state court in *Young v. State*, 879 A.2d 44, 47-48, 51-54 (Md. 2005) (applying *Frye*). These courts relied in part on the change from NRC I—which stated, in 1992, that statistical testimony was necessary, to NRC II—which stated, in 1996, that scientific advances allowed comparison of genetic markers at many more loci than previously and acknowledged that it might be appropriate to allow a source attribution:

Opinion testimony about uniqueness would simplify the presentation of evidence by dispensing with specific estimates of population frequencies or probabilities. If the basis of an opinion were attacked on statistical grounds, however, or if frequency or probability estimates were admitted, this advantage would be lost. Nevertheless, because the difference between a vanishingly small probability and an opinion of uniqueness is so slight, courts that decide on a criterion for uniqueness and determine that the criterion has been met may choose to allow the latter along with, or instead of, the former, when the scientific findings support such testimony.

NRC II, p. 195 (quoted by *Davis*, 602 F. Supp. 2d at 683). Both *Davis* and *Young* held that it was scientifically justifiable to testify to a match without accompanying statistics once the random match probability was as low as 1 in 300 billion. *Davis*, 602 F. Supp. 2d at 683-84; *Young*, 879 A.2d at 53-54.

In other cases, state courts have required that DNA evidence be accompanied by statistics indicating the significance of the match. *See, e.g., Commonwealth v. Mattei*, 920 N.E.2d 845, 854-55 (Mass. 2010) (deciding on relevance grounds, applying *Frye*; holding statistics necessary

when test could not exclude a person); *Commonwealth v. Barbosa*, 933 N.E.2d 93, 109 & n.14 (Mass. 2010) (deciding on relevance grounds, applying *Frye*; observing statistics were necessary regarding DNA match).

The Court recognizes that there are differences of expert opinion on source attribution. Admissibility under Rule 702 and *Daubert* does not require consensus, however, and the Court could conclude that this is an issue on which expert opinion on both sides is reliable enough for admission. A "battle of experts" is for the jury to resolve. *See Morrow*, 374 F. Supp. 2d at 63-64; *Chischilly*, 30 F.3d at 1155-56. But the Court will take a more conservative approach.

The federal district court in *Davis* observed that it had "broad discretion" to ensure that evidence was presented in an effective and efficient manner. *Davis*, 602 F. Supp. 2d at 684. Anticipating that the defendant would vigorously cross-examine the Government's expert on the statistical basis for her source-attribution statement, and considering the interest in time and clarity, the *Davis* court ordered the Government to present the statistical basis on direct examination—even though the court held that a source attribution could be given without statistics. *Id.* at 684-85. The *Davis* court recognized that the purposes of allowing a source attribution without statistics were simplicity and efficiency, but when the defendant was expected to "aggressively challenge the Government's expert on statistical grounds," any such advantage would be lost. *Id.* at 684.

The Government has statistical calculations for its DNA evidence. And the Court believes that Defendant intends to vigorously challenge the DNA evidence and the statistical calculations underlying the expert's opinions. As in *Davis*, the Court believes that the interest in clear and effective presentation of evidence to the jury will be served by having the Government present its statistical calculations in its case in chief; the Court finds that the interest in having

the evidence clearly presented to the jury outweighs the Government's interest in presenting expert conclusions without supporting statistics. The Court concludes that, when otherwise admissible, the Government will be able to present testimony that, to a reasonable degree of scientific certainty a person is "the source" of a DNA sample; however, the Government is ordered to also present the accompanying statistical calculations on direct examination of its expert.

Using a shotgun approach, Defendant argued that testimony giving a source attribution "is inadmissible under Rules 402, 403, and 702, as well as under *Daubert* and the due process, fair trial, and cruel and unusual provisions of the Fifth, Sixth, and Eighth Amendments to the Constitution." [Doc. No. 442, p. 109] Since Defendant fails to cite specific, persuasive authority for most of these bases, however, and the Court need not develop Defendant's conclusory arguments or address arguments unsupported by authority, the Court declines to address most of these points. *See Cahill*, 610 F.3d at 1238-39; *Arizona Pub. Serv. Co. v. United States EPA*, 562 F.3d 1116, 1130 (10th Cir. 2009). The Court observes that Defendant has overstated his argument under Rule 403, erroneously asserting that the Government intends to present expert opinion that Defendant is the "sole source," "to the exclusion of all other people in the world." The Court, however, finds that the evidence allowed under the procedure set forth above is admissible despite Defendant's various objections. In particular, the Court finds that evidence of the qualitative terms along with statistical calculations is relevant and will assist the jury in understanding the DNA evidence, and that the probative value of this evidence is not substantially outweighed by any danger of: unfair prejudice, confusing the issues, misleading the jury, undue delay, wasting time, or needlessly presenting cumulative evidence, under Rules

401, 402, and 403. This discussion, these findings, and the procedure required by the Court apply to all of the source attributions in the laboratory reports.

(c) Laboratory error rate

Citing some authority that laboratory error rates should be considered, Defendant argues that statistical calculations are inadmissible if they do not include a measure of laboratory error. [Doc. No. 442, pp. 136-39, 91-92; Doc. No. 562, p. 4 n.2] Defendant is not asserting that there was error in this case, but is instead arguing that the statistical calculations should take into account the potential for error based on a general error rate for all laboratories over time, or perhaps for this particular laboratory over time. The Government argues that challenges regarding laboratory error rates go to the weight of DNA evidence, not its admissibility. [Doc. No. 547, p. 40]

Defendant recognizes that NRC II recommends that laboratory error rates not be combined with match probabilities, but asserts that this recommendation should not be followed. [Doc. No. 442, p. 138] Defendant quotes the 2009 report of the National Research Council, NRC (2009), p. 121. [Doc. No. 442, pp. 139, 92; Doc. No. 562, p. 4 n.2] Although this quotation recognizes that it would be good to explore and determine error rates, it stops short of recommending that they be included in statistical calculations—as Defendant argues—and does not suggest determination of laboratory error rate as a prerequisite to admissibility.

Defendant also cites a Mississippi case, *Watts v. State*, 733 So. 2d 214, 224 (Miss. 1999). [Doc. No. 442, p. 139] Defendant states that *Watts* "declared," as suggested by one of the experts cited by Defendant, Dr. Jonathan Koehler, that "the introduction of statistical evidence can be meaningless without any evidence of the testing laboratory's error rate." [Doc. No. 442, p. 139 (quoting *Watts*, 733 So. 2d at 224)] The *Watts* case does not aid Defendant. In the

portion of the *Watts* opinion cited by Defendant, the Mississippi court upheld admission of DNA evidence (regarding the undershorts) without either statistical evidence or evidence of the laboratory error rates; in addition, the *Watts* court held that both statistical calculations and laboratory error rates go to the credibility of DNA matching evidence—not to its admissibility. *Watts*, 733 So. 2d at 224. In the next section of the opinion, the *Watts* court affirmed admission of DNA evidence (regarding the jacket) with statistical evidence, but apparently without evidence on laboratory error. The *Watts* case supports the Government's position that laboratory error rate is not required and goes only to weight of the evidence, not admissibility.

As Defendant recognizes, the National Research Council recommended in 1996 that laboratory error rates not be included in random match probabilities:

[W]e believe that a calculation that combines error rates with match probabilities is inappropriate. The risk of error is properly considered case by case, taking into account the record of the laboratory performing the tests, the extent of redundancy, and the overall quality of the results.

NRC II, p. 87. "The courts have almost uniformly followed the recommendation of the National Research Council." *State v. Tester*, 968 A.2d 895, 906 (Vt. 2009); accord *Roberts v. United States*, 916 A.2d 922, 930 (D.C. 2007). Relying on the scientific consensus reflected in NRC II, courts refuse to exclude DNA evidence on the ground that the laboratory did not calculate and include an error rate in the random match probability. See, e.g., *Beasley*, 102 F.3d at 1448; *Hicks*, 103 F.3d at 846; *Chischilly*, 30 F.3d at 1153; *Trala*, 162 F. Supp. 2d at 350; *Shea*, 957 F. Supp. at 340; *Roberts v. United States*, 916 A.2d 922, 930-31 (D.C. 2007) (applying *Frye* test). The Vermont court in *Tester* also adopted the recommendation of NRC II and held that the laboratory error rate, to the extent it could be known, goes to the weight of the DNA evidence, not its admissibility. *Tester*, 968 A.2d at 906.

"NRC II was deeply skeptical that a 'general error rate' based on the performance of different laboratories operating at different times . . . would be reliable or meaningful." *Roberts*, 916 A.2d at 931. According to NRC II, the way to address the possibility of laboratory error is through re-testing; the quotation above continues: "However, there is no need to debate differing estimates of false-match error rates when the question of a possible false match can be put to direct test, as discussed in the next section." NRC II, p. 87; *see Tester*, 968 A.2d at 906.

The Court notes that Defendant makes a speculative suggestion that he may not have been able to re-test some samples, which may have been consumed in testing, which may have been contrary to QAS. [Doc. No. 442, p. 38] The Government states that: evidence "has been available since August 2010 for Defendant to view, examine, or re-test"; "[a]t no point has Defendant requested any re-testing"; and "the DNA extract is retained and available to re-test." [Doc. No. 547, p. 33 n.35] The Court notes that Defendant does not assert that he made any request or attempt to re-test samples, that it has not been established as a factual matter that he could not have re-tested samples, and also that the QAS Defendant cites are not violated if it was not "possible" or "feasible" to retain portions of samples for re-testing. [Doc. No. 442, p. 38 & n.15] No issue here is presented or ripe for decision.

Thus courts hold that challenges based on laboratory error rate go to the weight of the DNA evidence, not its admissibility. *Beasley*, 102 F.3d at 1448; *Hicks*, 103 F.3d at 846; *Tester*, 968 A.2d at 906. As the *Morrow* court explained:

Defendant's argument on this score exhibits a fundamental misunderstanding of the principles of *Daubert*. The Court's concern under Rule 702 and *Daubert* is the reliability of the scientific methodology at issue, not the reliability of the laboratory performing the test. Put simply, "[a] laboratory's error rate is a measure of its past proficiency and is of little value in determining whether a test has methodological flaws." *Shea*, 957 F. Supp. at 340. What the defendant has sought to do here is challenge the proficiency of the tester rather than the

reliability of the test. Such challenges go to the weight of the evidence, not its admissibility.

Morrow, 374 F. Supp. 2d at 67.

In addition to the possibility of re-testing the DNA sample, the adversary system provides effective means for Defendant to challenge the Government's DNA evidence on the basis of laboratory error. Defendant is free to cross-examine the lab analyst. *See Hicks*, 103 F.3d at 846 (observing also that concerns about lab error arise with respect to any forensic evidence); *Tester*, 968 A.2d at 906; *Roberts*, 916 A.2d at 931. Further, the Court takes note of the Government's statement that the NMDPS Laboratory has quality control measures in place at every step in the testing process to ensure that samples are not contaminated or mishandled, along with corrective actions for any errors detected. [Doc. No. 547, p. 41] These attempts to control for laboratory errors provide additional reason to reject Defendant's argument. *See Trala*, 162 F. Supp. 2d at 350.

Considering the recommendation of the NRC II report, and the great weight of authority in the caselaw, the Court concludes that a "general error rate" is not a prerequisite to admissibility of the Government's random match probability statistics. Challenges based on laboratory error rates go to the weight of the DNA evidence, not its admissibility.

Defendant also argues that presentation of random match probabilities without including an estimate of laboratory error rate would be "more misleading than probative under Rule 403." [Doc. No. 442, p. 140] In view of the NRC II recommendation, and the explanation quoted above from the *Morrow* court, the Court does not find that the probative value of statistical calculations that do not include a laboratory error rate would be substantially outweighed by the danger of unfair prejudice under Federal Rule of Evidence 403. The *Morrow* court convincingly argues that laboratory error rate "is of little value in determining whether a test has

methodological flaws"—i.e., the weight and reliability of the DNA test. *Morrow*, 374 F. Supp. 2d at 67. As the *Morrow* court explains, what Defendant really seeks to do via laboratory error rate is to "challenge the proficiency of the tester rather than the reliability of the test." *Id.* Defendant will have the opportunity to cross-examine "the tester" at trial. There will not be "unfair prejudice" because information on laboratory error rates can properly be placed before the jury through the adversary system. The Court concludes that absence of a laboratory error rate does not violate Rule 403.

(d) Weak statistical significance

Defendant argues that the frequencies for probability of inclusion on three samples are of such weak significance that the DNA evidence should be excluded. [Doc. No. 442, pp. 118, 135-36] Defendant cites authority for his argument only under Rule 403. Defendant, in shotgun style, lists as additional bases for exclusion: Rule 402, Rule 702, *Daubert*, and "the Due Process, Fair Trial, and Cruel and Unusual Provisions of the Fifth, Sixth, and Eighth Amendments to the Constitution"; this listing appears only in the heading of Defendant's pleading. This Court need not address conclusory arguments for which no authority is provided. *See Cahill*, 610 F.3d at 1238-39; *Arizona Pub. Serv. Co.*, 562 F.3d at 1130.

For some populations, the laboratory reports show relatively high probabilities of inclusion for the Caucasian population: 1B22D—1 in 12 (swab of Smith & Wesson handgun; Sept. 30, 2010 report, p. 3); 1B72B—1 in 9268 (swab of Smith & Wesson handgun; Dec. 22, 2010 report, p. 4); and 31e—1 in 21 (swab of passenger side front door of Haas pickup; Dec. 22, 2010 report, p. 5). [Def's Ex. G6, laboratory reports] Defendant's argument is that the jury may place too much weight on relatively weak statistical evidence.

Under Rule 403, the Court must balance the probative value against the prejudicial effect of this evidence. *See United States v. Smith*, 534 F.3d 1211, 1218-19 (10th Cir. 2008). The Court denies Defendant's motion to exclude the DNA evidence.

The probative value of these three items of evidence appears to be great, in linking Defendant to handguns and to the Haases' pickup truck. *See Bonds*, 12 F.3d at 567. Rule 403 considers only "unfair prejudice"—suggesting decision on an improper basis (for instance, on an emotional basis). *Smith*, 534 F.3d at 1218-19. Unfair prejudice "does not mean the damage to a defendant's case that results from the legitimate probative force of the evidence." *Bonds*, 12 F.3d at 567. The Court finds that the statistical evidence is reliable and admissible under Rule 702; the relatively high statistical figures go to the weight, not the admissibility, and are matters which Defendant can challenge at trial. *See Bonds*, 12 F.3d at 567.

Courts are reluctant to set a threshold on the level of statistical significance, and have admitted DNA evidence when its statistical significance was relatively low. *See United States v. Graves*, 465 F. Supp. 2d 450, 458 (E.D. Pa. 2006). In *Morrow*, the court emphasized that such evidence, if found admissible under *Daubert*, should ordinarily be admitted, with the safeguards of the adversary system guarding against the jury assigning it too much weight; as the *Daubert* court stressed, the "traditional and appropriate means of attacking shaky but admissible evidence" are cross-examination, presentation of contrary expert evidence, and possibly jury instructions. *Morrow*, 374 F. Supp. 2d at 64-68. The random match probabilities for four DNA samples in *Morrow* were 1/12, 1/6, 1/3, 1/1. *Id.* at 55. The *Morrow* court held that it might be proper to admit this type of DNA evidence, because of the safeguards afforded by the adversary system; however, the court was rendering a decision on pretrial motions and observed that admissibility could be reconsidered later—with the court stating that it might sua sponte

reconsider the probative value of a 1:1 match before issuing its final decision on admissibility of the DNA evidence. *Id.* at 68.

In *Graves*, the random match probabilities were: 1 in 2,900 for the left shoe; 1 in 3,600 for the right shoe; and 1 in 2 for an umbrella. *Graves*, 465 F. Supp. 2d at 458. The court concluded that the DNA evidence on the shoes was admissible, but that "even with appropriate safeguards, the minimal probative value of the umbrella DNA evidence—in which half of the relevant population cannot be excluded as a contributor to the DNA sample—is substantially outweighed by the danger of unfair prejudice and confusion of the issues." *Id.* at 459.

A Vermont court upheld admission of a 1 in 12 match probability for mitochondrial DNA evidence. *State v. Brochu*, 949 A.2d 1035, 1048-49 (Vt. 2008). The court upheld the trial court's determination that, although this relatively high statistic had limited probative value, it was not substantially outweighed by prejudicial effect. *Id.* The trial court had properly observed that the defendant could challenge the weight of this evidence, and demonstrate its limited probative value, through cross-examination and presentation of contrary expert witnesses. *Id.*

Defendant cites *United States v. Natson*, 469 F. Supp. 2d 1253 (M.D. Ga. 2007). The DNA expert in *Natson* testified at a *Daubert* hearing that testing results were inconclusive as to whether the defendant was the father of the fetus, and that there was a 96.30% probability that the defendant was the father. *Id.* at 1255. The DNA scientific community, however, required over a 99% probability result to conclude that a DNA test established paternity; the expert therefore stated that he could not testify to a reasonable degree of scientific certainty that the defendant was the father. *Id.* at 1255, 1258. The *Natson* court therefore held this evidence inadmissible under Rule 702. *Id.* at 1258. The court further held that the evidence would also be inadmissible under Rule 403 because the jury might consider a 96.30% probability significantly

high, but the undisputed scientific evidence was that this probability was significantly low. *Id.* at 1259. On this ground, the limited probative value was significantly outweighed by the danger of unfair prejudice—especially the danger of misleading the jury. *Id.* *Natson* is not persuasive here, because the probability figure in *Natson* was explicitly recognized as not significant by the relevant scientific community.

The Court is persuaded by the approach of the cases that liberally allow admission of DNA evidence of relatively low statistical significance. These cases properly acknowledge the liberal standard of admission under *Daubert* and the Federal Rules, and the general presumption in favor of admission of "shaky evidence" with the danger of undue weight being countered by vigorous cross-examination, presentation of contrary expert witnesses, and the possibility of jury instructions to explain the issues. The Court recognizes that the 1 in 12 statistic is relatively high. But the Court finds that the probative values of these three pieces of DNA evidence are not substantially outweighed by any prejudicial effects. The Court anticipates that there will be much education of the jury on statistical issues, and much other evidence and cross-examination which will allow the jury to properly assess the DNA evidence and which will prevent the jury's placing undue weight on the statistical significance.

In making this decision, the Court is influenced by the decreased possibility of prejudice when the jury compares these high statistical probabilities with the very low random match probabilities of other items of evidence. The court in *Morrow* observed that the low statistical significance "actually benefits" the defendants, allowing them to argue that "hundreds, if not thousands, of others in the Washington, D.C. area cannot be excluded as possible contributors as well"; this line of attack would allow the defendants to significantly reduce any prejudice. *Morrow*, 374 F. Supp. 2d at 65. The National Research Council recognized this point. In NRC

II, this was described as the "defendant's fallacy"; research indicates that jurors may dismiss or undervalue DNA matches with high likelihood ratios "because other matches are to be expected in unrealistically large populations of potential suspects." NRC II, pp. 198; *see id.* at 133 ("The 'defendant's fallacy' is to assume that in a given population, anyone with the same profile as the evidence sample is as likely to have left the sample as the suspect.").

The Court finds that the probative values of Items 1B22D, 1B72B, and 31e are not substantially outweighed by any prejudicial effects.

(e) Population databases

Defendant argues that the statistical calculations were improperly restricted to five groups. [Doc. No. 442, p. 140] The Government states that the NMDPS Laboratory uses the FBI CODIS Popstats program, with the databases of African American, Apache, Caucasian, Navajo, and Southwest Hispanic to represent the overall population of New Mexico. [Doc. No. 547, p. 51]

Defendant relies heavily on the Nebraska case of *State v. Carter*, 524 N.W.2d 763 (Neb. 1994), *overruled by State v. Freeman*, 571 N.W.2d 276 (Neb. 1997). *Carter* was overruled, on the somewhat related point that *Carter's* rejection of the product rule was "outdated"; in addition, the *Freeman* court approved statistics calculated on the basis of only three population databases. *Freeman*, 571 N.W.2d at 293, 288-89. And these cases concern older methodology, RFLP and the fixed-bin method. Making the case even less persuasive, *Carter* explicitly rejected the *Daubert* test and reaffirmed that it continued to apply the *Frye* test. *Id.* at 779. In so doing, the *Carter* court specifically approved the two goals of "shield[ing] jurors from misleading or prejudicial scientific testimony," and "protecting the courts from unproven and potentially erroneous scientific theories." *Id.* at 777-78. When scientific evidence is "still the subject of

dispute and controversy," the *Carter* court reaffirmed that it should not be admitted. *Id.* at 779. These principles, of course, are entirely at odds with the federal courts' approach, and undermine any persuasive effect of the *Carter* opinion. In accordance with the *Frye* test, the *Carter* court excluded the DNA evidence because the statistical probability evidence did not meet the *Frye* test of general acceptance. *Id.* at 782-83. The *Carter* court characterized the limitation to two population groups as "questionable"; this discussion was merely part of the *Carter* court's determination that admission of the DNA evidence was more prejudicial than probative. *Id.* at 785-86. The *Carter* case is not persuasive, primarily because of the use of the *Frye* test; in addition, the restriction was to just two populations, and the court merely called this "questionable."

Defendant cites the unpublished district court opinion in *Peters* in support of an argument that the Government should not be allowed to "limit[] the statistical evidence to only five distinct groups." [Doc. No. 442, p. 141] *United States v. Peters*, Cr. No. 91-395-SC, 1995 U.S. Dist. LEXIS 20950 (D.N.M. 1995), *aff'd*, 133 F.3d 933 (10th Cir. 1998) (unpublished). It appears, however, that only five population databases were used in *Peters*—the same number as in Defendant's case. *Id.* *7-8, 116.

NRC II states that statistics should be based on the most relevant population or populations. NRC II, p. 127. The Government asserts that the five groups used do represent the overall population of New Mexico. Defendant appears to assert, without persuasive and specific authority, that some additional databases should be used. Defendant appears to raise an argument under Rule 403, asserting that statistics based on the five groups would mislead the jury. [Doc. No. 442, p. 142] The Court finds that the probative value of the DNA evidence, based on the five databases, is not substantially outweighed by the danger of unfair prejudice.

The Court also determines that Defendant's challenges to the statistical calculations, as discussed above, go to the weight of the DNA evidence, not its admissibility under Rule 702.

E. Low Copy Number (LCN) Testing

(1) Item 1B23B

The Government argues that its DNA evidence on Item 1B23B (swab from bottom of Smith & Wesson magazine) is admissible under *Daubert* and Rule 702. Davis's lab report states her conclusion that Item 1B23B is a single source sample and that its source was Tracy Province, based on a match at 11 out of 15 loci:

A partial DNA profile was obtained from item 1B23B (at 11 of the 15 loci). To a reasonable degree of scientific certainty, Tracy Province is the source of this partial DNA profile.

[Def's Ex. G6, Sept. 30, 2010 report, p. 3] The amount of DNA in Item 1B23B is 215 picograms (pg)—making this a Low Copy Number (LCN) result, according to the NMDPS Lab's protocol. [Tr. 5/6/13, p. 142]

Defendant argues that Low Copy Number (LCN) DNA testing "is not considered generally reliable even in the forensic science community." [Doc. No. 442, p. 87] Defendant also suggests that there may be "many more LCN samples," in addition to the one identified by the Government, possibly some of the mixed samples. [Doc. No. 442, p. 87]

On May 6-7, 2013, the Court held an evidentiary hearing on the issue of admissibility under *Daubert* and Rule 702 of LCN testing results. Defendant was present at this hearing. The Court had directed the parties to address a number of questions on LCN testing—including admissibility of DNA evidence on Item 1B23B, and whether evidence from any other samples, including mixed samples, constitutes LCN testing "with respect to any contributor for whom the Government intends to introduce testing results." [Doc. No. 895, p. 2] The Court heard

testimony from three witnesses: Dr. William Watson and Carrie Zais Davis for the Government, and Dr. Dan Krane for Defendant. The Court admitted into evidence approximately 100 additional exhibits. [Tr. 5/7/13, pp. 403-04]

When there is too small a sample, the DNA testing (which would otherwise be reliable and yield results admissible under *Daubert* and Rule 702) may yield unreliable and nonreproducible results because of the significant increase in stochastic effects. *See, e.g.*, Peter Gill, *Application of Low Copy Number DNA Profiling*, 42(3) Croatian Med. J. 229, 229-30 (2001) [Def's Ex. P7; Gov's Ex. 9 (5/6/13); Tr. 5/6/13, p. 67]. LCN testing carries a greater potential for error due to difficulties in analysis and interpretation caused by four stochastic effects: allele drop-in, allele drop-out, stutter, and heterozygote peak height imbalance. John M. Butler, *Fundamentals of Forensic DNA Typing* 331 (2010) [Gov's Ex. 34 (5/6/13)]. "Trying to generate a reliable STR profile with only a few cells from a biological sample is similar to looking for an object in the mud or trying to decipher the image in a fuzzy photograph." *Id.* Interpretation of LCN results is "not straightforward," and additional interpretive guidelines may be required. Peter Gill, *supra*, at 229.

Laboratories may set an "empirically determined threshold (usually termed a 'stochastic threshold')" to establish a sample quantity which puts a sample "in the potential danger zone of unreliable results." John M. Butler, *Advanced Topics in Forensic DNA Typing* 339 (Academic Press 2011) [Gov's Ex. 34a (5/6/13)]. "For example, if the total amount of measured DNA is below 150 pg, a laboratory may decide not to proceed with PCR amplification assuming that allelic drop-out due to stochastic effects is a very real possibility." *Id.* "Alternatively, a laboratory may proceed with testing a low-level DNA sample and then evaluate the peak height signals and peak ratios at heterozygous loci." *Id.*

Most laboratories in the U.S. do not perform LCN testing. There are few reported U.S. cases on LCN testing. According to a New York court, the New York City Office of the Chief Medical Examiner (NY OCME) is the only government facility currently using LCN testing, but several private and academic laboratories in the U.S. perform LCN testing. *People v. Garcia*, 963 N.Y.S.2d 517, 521 (N.Y. Sup. Ct. 2013). LCN testing has been used in some other countries, however, for more than thirteen years now. [Doc. No. 547, p. 29] *People v. Megnath*, 898 N.Y.S.2d 408, 411 (N.Y. Sup. Ct. 2010).

Laboratories often use different procedures for LCN samples. There are cases from New York trial courts holding LCN results admissible—including the case cited by the Government, *Megnath*, 898 N.Y.S.2d at 413. *See also Garcia*, 963 N.Y.S.2d at 523. Applying the *Frye* test, these courts admitted the results of LCN testing conducted by the NY OCME; the NY OCME has been conducting LCN testing for some time—but using special procedures, increasing the amplification from 28 to 31 cycles. Some labs use a post-amplification purification process for LCN samples. (Tr. 5/6/13, pp. 17, 22, 27)

The NMDPS Laboratory, in contrast, states that it uses no special procedures or methods of interpretation for LCN testing.

There are a number of different definitions of LCN testing. Charlotte Word, *What is LCN?—Definitions & Challenges*, Promega Corp. (2010) [Def's Ex. C10] (available at <http://www.promega.com/pubhub>); *see United States v. Davis*, 602 F. Supp. 2d 658, 668 (D. Md. 2009); *United States v. Williams*, 2009 WL 1704986, *2-5 (C.D. Cal. 2009) (unpublished) (definitions differ, but according to "weight of scientific authority," testing can constitute LCN without increase in amplification cycles or other changes in procedure, when amount of input DNA is small enough). Different definitions focus on: (1) the amount of DNA tested (often

setting a limit at less than 200 pg or less than 100 pg); (2) modifications to methodology to increase sensitivity (often increasing the number of PCR cycles from 28 to 31 or 34); or (3) DNA profile appearance exhibiting increased imbalance of observed alleles. John M. Butler, *Advanced Topics, supra*, at 311 [Gov's Ex. 34a (5/6/13)]. "In all these definitional approaches, it is recognized that data reliability is inferior when lower amounts of DNA are tested and thus additional measures must be taken to improve the chance of obtaining results that accurately reflect the sample being examined." *Id.* at 311-12. Another recognized authority states that "LCN typing is better defined as the analysis of any results below the stochastic threshold for normal interpretation." Bruce Budowle et al., *Low Copy Number—Consideration and Caution*, FBI Lab. Div. No. 01-26, p. 1 (2001) [Def's Ex. O7]. "The success rate is low; often the results cannot be interpreted or are meaningless for the case." *Id.* at 4.

The Government presented testimony on definitions of LCN testing, appearing to take the position that LCN generally refers to modifications of procedure, or testing of quantities below 100 pg or 200 pg. The focus for the Court, however, is not to establish a definition of "LCN testing," but to determine whether the Government's DNA results in this case are reliable and admissible. According to the NMDPS Laboratory's own protocol, Item 1B23B is declared to contain too small a quantity to yield the normally reliable DNA profile obtained through PCR/STR testing; Item 1B23B, at 215 pg, is below the Lab's "stochastic threshold" and therefore "in the potential danger zone of unreliable results."

The NMDPS Lab's SOP sets forth the Lab's empirically determined stochastic threshold for testing with Identifiler:

LOW COPY NUMBER (LCN) SAMPLES

Validation studies for both Identifiler and Yfiler STR kits have demonstrated a range of total input amounts of DNA where amplification

stochastic effects are observed. For Identifiler, samples with a total input amount of DNA less than 250 picograms (0.25 ng) demonstrate stochastic effects and should be evaluated and interpreted with caution. . . .

Per CODIS rules, any sample amplified at these amounts or less and injected on a genetic analyzer for 10 seconds is not eligible for entry into CODIS. If the sample is of good enough quality at a 5 second injection for entry into CODIS, the analyst should print the electropherograms from both the 5 and 10 second injections and include both in the case file for review. The 5 second injection can be used for CODIS entry and the 10 second injection for interpretation on the report.

NMDPS Biology SOP, pp. 13-9 to 13-10 (approved 4/1/11) [Def's Ex. N6]. Davis testified that this LCN threshold was set because in validation studies conducted by the NMDPS Lab, testing quantities less than 250 pg resulted in stochastic effects. [Tr. 5/6/13, p. 131] Watson testified that each laboratory generally establishes its own stochastic threshold for quantity of input DNA, and that this threshold will vary from lab to lab depending on the procedures and instruments used. [Tr. 5/6/13, pp. 65-66] The NMDPS Lab also set a stochastic threshold based on the height of the electropherogram peaks, establishing as too low for interpretation peaks below 100 relative fluorescent units (RFUs).

Watson testified that the partial DNA profile, exhibiting allele drop-out, for Item 1B23B confirms that the NMDPS Lab has set its stochastic threshold at an appropriate level for its protocol. [Tr. 5/6/13, p. 44] He observed that this result "validates" the Lab's "validation," showing that the Lab is correct that their lowest quantity for optimal results is 250 pg; with the NMDPS Lab's procedures, they do not expect to get a reliable and full DNA profile with less than 250 pg of input DNA. (*Id.*)

The Court recognizes that the NMDPS Lab's stochastic threshold is higher, at 250 pg, than the level defined as LCN by other labs and authorities. Other labs may get reliable results with lower quantities; procedures and results and stochastic thresholds vary from lab to lab. But

what is important is that the NMDPS Lab has empirically determined that 250 pg is its own stochastic threshold; this means that the NMDPS Lab recognizes that, applying its own protocols and using its own instrumentation, it expects to see stochastic effects that may render the results unreliable when a sample under 250 pg is tested. The question before the Court is whether the Government has carried its burden of demonstrating, by a preponderance of the evidence, that the LCN testing by the NMDPS Lab in this case is nevertheless reliable.

The Government presented argument and testimony showing that a number of other laboratories around the world, and a few in this country, perform LCN testing. [Doc. No. 547, pp. 29-30; Tr. 5/6/13, pp. 27-29] The Government appears to argue that the use of LCN testing in these laboratories supports the Government's position that LCN results are admissible in the case before the Court. [See also Doc. No. 547, p. 29] But the question before this Court is not whether it is possible to perform LCN testing reliably—but instead whether the LCN testing performed in this case, by the NMDPS Lab, is reliable. First, the demonstration that LCN testing is done in other countries does not constitute any showing that those LCN results would meet the standard for admissibility under *Daubert* and Rule 702. Second, and more important, other laboratories use different procedures; even if it were shown that their LCN results were reliable, that would say nothing about whether the LCN results from the NMDPS Lab procedures are reliable. [Tr. 5/7/13, pp. 229-33 (Krane testifying that other labs modify their procedures and/or their statistical calculations for LCN testing); Tr. 5/6/13, pp. 14, 16-18, 22-29 (Watson testifying that other labs generally use modified procedures)]

There are many cases addressing admissibility in general of the PCR/STR method of DNA analysis, as discussed above; based on its acceptance by the vast majority of courts and overwhelming scientific and forensic acceptance, the Court concluded that PCR/STR analysis is

reliable and admissible under *Daubert* and Rule 702. In contrast, there are few reported cases on admissibility of LCN testing under *Daubert* and Rule 702, and the scientific literature is unclear and often addresses different procedures.

The Government cites one case from the Supreme Court of Queens County, New York, *People v. Megnath*, 898 N.Y.S.2d 408 (N.Y. Sup. Ct. 2010). [Doc. No. 547, p. 30] After an evidentiary hearing, the *Megnath* court held that the LCN test results from the New York Office of the Chief Medical Examiner (NY OCME) were admissible under *Frye*. Defendant erroneously argues, [Doc. No. 562, pp. 8-9] that *Megnath* is not persuasive because it was decided under *Frye*; the case, however, would be more persuasive for admissibility under *Daubert*, since LCN testing was held to satisfy the more restrictive *Frye* test. But *Megnath* is not persuasive, for a number of reasons. First, the NY OCME uses different procedures and interpretive methods than the NMDPS Lab; for instance, the NY OCME increased the number of amplification cycles from 28 to 31. Second, the NY OCME has done extensive internal validation of its LCN testing and has received certification and approval for it, *Garcia*, 963 N.Y.S.2d at 521-22; no similar certification and approval has been demonstrated for LCN testing as performed by the NMDPS Lab. Third, the *Megnath* court held an evidentiary hearing and based its holding on the testimony and credibility of the witnesses presented in that court. Fourth, the *Megnath* court made the questionable findings that the *Frye* test only applies to novel scientific evidence and that LCN testing was "not a novel scientific technique" (despite changes in procedure and interpretive methods). *Megnath*, 898 N.Y.S.2d at 414-15. Fifth, the *Megnath* court did not account for the increase in stochastic effects in LCN testing, merely observing that stochastic effects may occur in any testing.

The unpublished federal case cited and submitted by the Government, *Williams*, does not aid the Government. [Doc. No. 547, p. 27; Gov's Ex. 36 (6/25/12); Gov's Ex. 14 (5/6/13)] The Court observes that the Government's Exhibit List for the May 6-7, 2013 evidentiary hearing erroneously states in a parenthetical for *Williams*: "(admitting LCN over Dr. Krane's criticisms)." On the contrary, the federal district court found that LCN testing was not in fact conducted in that case, because the quantities of input DNA in the two samples at issue (0.6 ng and 0.3 pg) were above 0.2 ng and above the stochastic threshold; the court therefore concluded that no determination on admissibility of LCN testing was required. *United States v. Williams*, 2009 WL 1704986, *1-3, 5-6 (C.D. Cal. 2009) (unpublished). The *Williams* court had earlier denied the defendant's motion for a *Daubert* hearing, holding that the court could conclude on the basis of caselaw and scientific literature that PCR/STR testing was admissible under *Daubert* and Rule 702—with the exception of LCN results, on which the court reserved ruling. *United States v. Williams*, 2008 WL 5382264, *15-17 (C.D. Cal. 2008) (unpublished). If there were LCN testing, the court held, an evidentiary hearing would have been required to determine whether LCN results met the standard for admissibility. What *Williams* illustrates is that a *Daubert* hearing is not necessary to hold that PCR/STR testing is admissible under *Daubert* and Rule 702, but that the reliability and admissibility of LCN testing has not been established.

The scientific literature cited by the parties does not give the Court a sound basis for decision. A number of leading authorities in the field take the position that LCN testing is not reliable. [Tr. 5/6/13, pp. 47-50] *See, e.g.,* Bruce Budowle, *Low Copy Number Typing Still Lacks Robustness and Reliability*, available at <http://www.promega.com/resources/articles/profiles-in-dna/low-copy-number-typing-still-lacks-robustness-and-reliability> (2010) [Def's Ex. B8]. Although the Government cites some authorities as supporting the reliability of LCN testing,

these authorities are discussing laboratories using different procedures and methods than the NMDPS Lab; these authorities therefore do not demonstrate that the NMDPS Lab's procedures and methods yield reliable results. [Doc. No. 547, pp. 29-30; Tr. 5/6/13, pp. 229-32] Articles cited by the Government as demonstrating "general acceptance [of LCN testing] in the scientific field" do not support this claim. [Doc. No. 547, p. 29 (citing A. Lowe et al., *Use of Low Copy Number DNA in Forensic Inference*, Progress in Forensic Genetics, available at http://www.isfg.org/files/31f9316afbc584bc0befd4454d6cd38c4f064f3a.02004843_693490260903.pdf (discussing testing by Forensic Science Service, U.K.); Jennifer J. Raymond et al., *Trace DNA Analysis: Do You Know What Your Neighbor Is Doing?: A Multi-Jurisdictional Survey*, available at <http://www.fsigenetics.com/article/S1872-4973%2807%2900106-8/fulltext> (discussing testing in Australia and New Zealand)] The Court observes that the parties presented thousands of pages of exhibits; the Court cannot be expected to comb through that huge volume of material to see whether scientific articles which were not specifically cited or referred to would support the Government's argument that the NMDPS Lab's LCN testing was reliable. *See United States v. Griebel*, 312 Fed. Appx. 93, 97 (10th Cir. 2008) (unpublished) (combing through record in search of support for party's argument is not court's function); *Mitchell v. City of Moore*, 218 F.3d 1190, 1198-99 (10th Cir. 2000) (district court is not required to search through thousand-page appendix; if court were required to go beyond referenced portions of material submitted, court's workload would be insurmountable).

At the May 6, 2013 evidentiary hearing, the Government offered the testimony of Dr. William Joseph Watson, a self-employed forensic DNA consultant with contracts as auditor and inspector for the American Association of Laboratory Accreditation. Watson worked in the field of forensic science for almost twenty years—as a forensic scientist, lab director, and lab auditor.

He has a Ph.D. in molecular biology. He has testified ninety-one times as an expert in DNA analysis. The Court qualified him, without objection, as an expert in forensic DNA analysis. [Tr. 5/6/13, pp. 7-14]

Watson testified generally about LCN testing. Watson testified that: there are different definitions of LCN testing, different laboratories perform different procedures for LCN testing, he knew of about ten U.S. laboratories conducting LCN testing, and laboratories in other countries perform LCN testing. Watson was not entirely familiar with the NMDPS Lab's protocol, and did not review the case file notes in this case. [Tr. 5/6/13, pp. 55, 102-03, 106-07] Watson did look at one DNA profile in this case, on Item 1B23B. [Tr. 5/6/13, p. 55] On cross-examination, Watson testified that some leading members in the DNA forensic community believe that LCN testing is not reliable [Tr. 5/6/13, pp. 47-50]

The Government also presented testimony by Carrie Zais Davis. The Court qualified Davis, without objection, to testify as an expert in DNA analysis. [Tr. 5/6/13, p. 130] Davis testified that there were a total of six LCN results in this case—Item 1B23B, and five others which were uninterpretable. [Tr. 5/6/13, pp. 133-34] Item 1B23B was 215 picograms. [Tr. 5/6/13, p. 142] Davis's lab report states her conclusion that Item 1B23B was a single source sample and that its source was Tracy Province, based on a match at 11 out of 15 loci:

A partial DNA profile was obtained from item 1B23B (at 11 of the 15 loci). To a reasonable degree of scientific certainty, Tracy Province is the source of this partial DNA profile.

[Def's Ex. G6, Sept. 30, 2010 report, p. 3] At the May 6, 2013 evidentiary hearing, however, Davis testified that one additional locus could not be used for interpretation and statistical calculations (because one peak at TPOX was below the Lab's stochastic threshold of 100 RFUs); therefore, it was a match at 10 of the 15 loci. [Tr. 5/6/13, p. 146]

Davis testified that the NMDPS Lab does not modify its procedure when testing an LCN sample: "We would treat it just as we treat any other sample that we're testing in the lab and interpret it—I would say with caution." [Tr. 5/6/13, p. 138; Tr. 5/6/13, pp. 180, 191] The Lab does not increase the amplification cycles from their usual 28 cycles, and does not do any post-amplification cleanup or purification of the sample. [Tr. 5/6/13, pp. 138, 141-42] But, Davis testified, "maybe you have a red flag that maybe you should be looking for stochastic effects," although she added that the analyst would be doing that even with a sample that was not LCN. [Tr. 5/6/13, pp. 138-39]

Davis testified about the electropherogram produced on Item 1B23B after a ten-second injection. [Gov's Ex. 60 (5/6/13)] Based on its validation studies, the NMDPS Lab had set a stochastic threshold of 100 Relative Fluorescent Units (RFU); peaks below 100 RFUs are not used for interpretation and formulating statistics, though peaks between 50 and 100 RFUs can be used to exclude a profile. [Tr. 5/6/13, p. 135] With regard to this electropherogram, Davis observed that there was complete drop-out (locus drop-out) at two loci (CSF1PO and D2S1338); the peaks were below 100 RFUs at two more loci (D7S820 and D16S539); and one of the two peaks at another locus (TPOX) was below the stochastic threshold. [Tr. 5/6/13, pp. 134-38] Thus, of the 15 loci, only the results for 10 loci were good enough to use for interpretation and statistics. [*Id.*]

Davis did testify that the "regular injection" on the ABI 3130 is five seconds, and that she injected this sample for ten seconds—which, "essentially . . . is just doubling the amount of DNA that gets injected into the actual instrument," in order to help raise peaks above the 100 RFU threshold and make them interpretable. [Tr. 5/6/13, p. 139-40] Davis testified, however, that the Lab had determined that they could use either a five-second or ten-second injection on

any sample, whether LCN or not. [Tr. 5/6/13, pp. 139-40] She stated that this was not a matter of following a different procedure for an LCN sample. [Tr. 5/6/13, p. 140] When asked whether a ten-second injection was typically used for an LCN sample, Davis answered that it was up to the analyst's discretion but then said probably the analyst would run a ten-second injection for an LCN sample:

Question: Okay. Now when you have an LCN, do you typically always do a 10-second injection?

Davis: I guess it just depends on the analyst running the sample. But I mean, I would say most analysts probably would run 10-second injections on a low copy number sample, yes.

[Tr. 5/6/13, p. 141]

Davis testified that to determine whether she obtained a reliable profile from 1B23B, she looked for peak height balance between the "called alleles" (those represented by peaks above the 100 RFU threshold). [Tr. 5/6/13, p. 143] Davis testified that, if the peak heights at heterozygous loci are within a 70% ratio, that shows her that she has "what we would call a normal sample, or just something that's not showing stochastic effects." [*Id.*]

Defendant offered testimony by Dr. Dan Krane, a biology professor at Wright State University with numerous publications, several dealing specifically with LCN testing. The Court qualified him, without objection, as an expert in molecular biology. Krane testified that he had received the electronic data on Item 1B23B, from which he generated his own electropherograms. [Tr. 5/7/13, pp. 216; Def's Ex. D10] Krane testified that when there is allele drop-out (or locus drop-out, in which there must be underlying allele drop-out) at some loci, there may be allele drop-out at other loci; since there was allele (or locus) drop-out at four or five loci in the electropherograms for Item 1B23B, there could also be drop-out at some of the ten or eleven other loci. [Tr. 5/7/13, pp. 224-27] Krane testified that drop-out and drop-in are

two of the most difficult problems in LCN testing because, once drop-out is observed at some loci, it is often not possible to assess the likelihood that there was also drop-out at other loci. [Tr. 5/7/13, pp. 224-27]

Krane testified that, although other labs might alter their procedures when performing LCN testing, the NMDPS Lab asserts that it does not. The essential difference for the NMDPS Lab is their protocol requiring that LCN samples must be evaluated and interpreted "with caution"; however, in Krane's opinion, Davis did not interpret Item 1B23B with caution. [Tr. 5/7/13, pp. 229-31, 236-37] Other labs, for example, in the United Kingdom, modify their statistical formulas to account for the possibility of drop-out in LCN samples; the NMDPS Lab, however, did not make such modifications. [Tr. 5/7/13, pp. 231-32] In Krane's opinion, the testing results were not interpreted in a reliable manner. [Tr. 5/7/13, p. 233]

The Court identifies four important points, all indicating that the Government has failed to carry its burden of demonstrating the reliability of the NMDPS Lab's LCN testing.

First, to determine whether there was 70% peak height balance in the profile, Davis considered only the "called alleles"—i.e., only those loci for which both alleles were above the 100 RFU stochastic threshold; Davis thus ignored the TPOX locus because one of the peaks at TPOX was below the stochastic threshold of 100 RFUs. Davis did not provide an explanation for ignoring TPOX, and did not cite to any scientific studies or literature to support her conclusion. When asked by the Court about reliability of the LCN profile and stochastic effects, the Government's other expert witness, Watson, pointed out that there was peak height imbalance at TPOX which "could be attributable to stochastic effect." [Tr. 5/6/13, pp. 102-04, 109] At TPOX, the two alleles were 68 and 133 RFUs—which is a ratio of 51%, and not close to the 70% ratio which Davis said constitutes sufficient balance to indicate reliability of the

profile. [Gov's Ex. 60 (5/6/13) (10-second injection)] Krane also pointed out that there was peak height imbalance at TPOX, which undermines Davis's assertion that the profile was reliable because there was peak height balance overall. [Tr. 5/6/13, pp. 225-26]

Second, Davis admitted that the result of a ten-second injection was not eligible for entry into CODIS. [Tr. 5/6/13, pp. 157, 187] This exclusion is stated in the NMDPS Lab's protocol. [Def's Ex. N6, p. 13-9] When asked if the reason for the exclusion was to prohibit entry into CODIS of unreliable DNA results, Davis was unable to provide any other explanation. [Tr. 5/6/13, pp. 156-60] There is a suggestion here that ten-second injection results in unreliable results, which the Government failed to rebut. The Court recognizes Davis testified, somewhat unclearly, that FBI standards would have prevented entry into CODIS of the results on 1B23B at any event [Tr. 5/6/13, pp. 162, 187-88]; however, the Court is concerned with the reliability of the NMDPS Lab's testing of LCN samples with a ten-second injection—not just with whether a DNA result on this particular item would have been ineligible for entry into CODIS for some additional reason.

Third, no replicate testing was done by the NMDPS Lab, although authoritative articles state that this is an important means of ensuring reliability for LCN testing. [Tr. 5/6/13, pp. 82-83] *See, e.g.,* John M. Butler, *Fundamentals of Forensic DNA Typing* 332 (2010) [Gov's Ex. 34 (5/6/13)]; John M. Butler & Carolyn R. Hill, *Scientific Issues with Analysis of Low Amounts of DNA*, pp. 6-7, 14-15 (2009) [Gov's Ex. 2 (5/6/13)]. "[T]his replicate amplification strategy has become the core feature of reliable low-level DNA testing." John M. Butler, *Advanced Topics in Forensic DNA Typing: Methodology* 313 (2011) (emphasis added) [Gov's Ex. 34a (5/6/13)]. Butler states: "Laboratories should not report out a single result with LCN STR analysis (see

Figure 11.4)." *Id.* 340. Figure 11.4 states that the result of a single amplification of an LCN sample "can be unreliable." *Id.* 328.

Fourth, and most important, Davis did not present a good explanation, or scientific basis, for her opinion that the profile on 1B23B was reliable despite the clear stochastic effects of drop-out at four or five loci; the following is Davis's testimony on direct examination:

Government's Counsel: And for example if you see stochastic effect at one [locus], why are the others still reliable?

Davis: Just based on my experience in interpreting. I mean, to me, it looks like a single-source reliable profile.

. . . .

Government's Counsel: Okay. And I guess I keep going back to how do you know that one of them [the other loci] isn't exhibiting something with a stochastic effect?

Davis: Again, peak height ratios, we rely on that a lot to show whether or not there is stochastic effect. I mean, there's no—it doesn't look like there's a lot of alleles that just haven't been called, meaning there's not little tiny blips on the electropherogram that could potentially be another allele that just aren't called.

Government's Counsel: Okay. And so that's what tells you that it is a reliable profile?

Davis: Yes.

Government's Counsel: Or I should say an interpretable profile. Is that a better way to say it?

Davis: Yeah. I mean, yes, it's definitely an interpretable profile.

Government's Counsel: Okay. And being that it is interpretable, does that make it reliable?

Davis: Yes.

Government's Counsel: Even though it is, by your lab standards, classified an LCN?

Davis: Correct. Yes.

[Tr. 5/6/13, p. 144-45]

On cross-examination, Davis still failed to provide a good explanation for her conclusion, and still failed to cite any scientific studies or literature to support her approach or her conclusion. Davis repeated that peak height balance of 70%—but only considering "called alleles" (i.e., those above 100 RFUs, so ignoring TPOX)—was "an indication of whether or not there [are] stochastic effects." [Tr. 5/6/13, p. 148] But allele drop-out is a stochastic effect, and

the sample indisputably exhibited allele drop-out—at four or five loci. Defense Counsel questioned Davis about how she could conclude that peak height balance at five loci showed that there were no stochastic effects at other loci—when it was clear that there was drop-out at four or five other loci. Davis's assertion that there was peak height balance, overall, is undermined by these drop-outs; according to Butler, "Allele drop-out can be thought of as an extreme form of heterozygote peak imbalance." John M. Butler, *Fundamentals of Forensic DNA Typing* 331 (2010) [Gov's Ex. 34 (5/6/13)]. In addition, five loci appeared to be homozygous; with only one peak there was no balance to look for at those five loci. [Tr. 5/6/13, pp. 147-55] That left only five out of fifteen loci which Davis considered in reaching her determination that there was peak height balance "overall"—on which she then based her conclusion that the profile was reliable. Davis merely asserted—again without citing any support for this opinion—that it was enough if she observed peak height balance at "about half of the profile," and that she could judge from balance at five loci that there was "most likely" not drop-out at other loci. [Tr. 5/6/13, pp. 151-54; *see also* pp. 189-90] She testified that her assumption that there was no drop-out in the five loci showing homozygous results constituted an interpretation made "with caution," in accordance with the Lab's SOP for LCN results. NMDPS Biology SOP, pp. 13-9 to 13-10 (approved 4/1/11) [Def's Ex. N6]. When pressed, Davis merely stated that her experience supported her conclusion:

Davis: I'm making the determination that, in my experience, that it's not likely that there's drop-out at the ones that are shown as homozygotes.

Defense Counsel: And what is it about your experience that tells you that in regard to this particular sample?

Davis: Because I've looked at thousands and thousands of samples before.

[Tr. 5/6/13, p. 153] When asked by the Court to justify her conclusion that the profile was reliable, even though it was admittedly below the Lab's 250 pg stochastic threshold, and

stochastic effects were in fact observed, Davis again blithely cited her experience: "So I guess, just based on my experience, I would say that this is a reliable profile." [Tr. 5/6/13, pp. 190-91] Davis did not further justify or support her conclusion; she did not cite to any particular expertise with LCN testing, nor did she cite any specific testing or scientific literature.

When the Court asked whether there was a way to test her conclusion, Davis cited the statistics she had generated and said "the statistical weight on it, too, would give it more reliability." [Tr. 5/6/13, pp. 191-92] On recross-examination, however, Davis retracted this statement, admitting that the statistical calculations had nothing to do with the reliability of the profile itself. [Tr. 5/6/13, p. 194]

The difficulty with Davis's conclusion is that, if there were drop-out at one of the five loci exhibiting homozygous results in the electropherogram, the profile would no longer be attributable to Tracy Province. Davis based her conclusions on the results of the ten-second injection, shown in Government's Exhibit 60. The results of the five-second injection, shown in Government's Exhibit 60a, show at locus D3S1358 a peak of 69 RFUs (10.1%), which is just below the stutter threshold for that locus (10.7%), so it was not considered by Davis. If that peak were in fact an allele that had dropped out, so that the sample was heterozygous at locus D3S1358, Tracy Province (who is homozygous at that locus) would have been excluded as the source of item 1B23B. [Tr. 5/6/13, pp. 165-69] This point was also illustrated in testimony by Krane. [Tr. 5/7/13, pp. 220-24]

Watson testified that one of the criticisms of LCN interpretation is that, once stochastic effects have occurred at some loci, there is no way to be certain that the stochastic effects were confined to those loci and did not occur at other loci. [Tr. 5/6/13, pp. 108-10] Krane testified that, once allele (or locus) drop-out occurs at some loci, there may be allele drop-out at other

loci. [Tr. 5/6/13, pp. 224-27] Contrary to Davis's testimony, Krane testified that it would not be "scientifically sound" to generally conclude that there was no drop-out at other loci because there was peak height balance at some loci; unless such an approach could be reduced to a mathematical formula or a set of rules, it would not be "a sound scientific practice." [Tr. 5/7/13, pp. 224-25] But Davis was not relying on a formula, a set of rules, or any evidence to support her impression that the profile was valid—merely asserting her opinion that there was not drop-out at other loci (in addition to the four or five clearly exhibiting drop-out), because five peaks were in balance. Krane's opinion was that laboratories would be inclined to "describe the whole sample as simply being inconclusive," when a profile such as that for 1B23B was obtained. [Tr. 5/6/13, p. 227]

The Court does not find credible Davis's testimony and conclusion on the reliability of the DNA profile for Item 1B23B. The Court is not persuaded by Davis's insistence that her experience—without citation to scientific studies, scientific literature, or any special training—justified her conclusion. *See Dodge*, 328 F.3d at 1222 (expert opinion must be based on actual knowledge, not "'subjective belief or unsupported speculation,'" quoting *Daubert*, 509 U.S. at 590). It is not sufficient to simply point to lengthy experience in the field, without explaining how that experience supports the expert's opinion. *Ho v. Michelin N. Am., Inc.*, 2013 WL 1277023, *6 (10th Cir. 2013) (unpublished). "Experience is not necessarily a password to admissibility" *Id.* The Court notes that, despite her years of practical experience, Davis has never attended any classes or workshops specifically on LCN testing. [Tr. 5/6/13, p. 169] Krane, on the other hand, has a Ph.D. and a number of publications in the field. The Court finds credible Krane's testimony that Davis's conclusion was not "scientifically sound." The Court finds that Davis did not provide a sufficient explanation for her conclusion that the DNA profile

for Item 1B23B was reliable. A court making a determination of reliability under *Daubert* and Rule 702 is justified in rejecting the "ipse dixit" of an expert. *Joiner*, 522 U.S. at 146. The Court concludes that this case, with respect to LCN testing, is like *Joiner* and *Tyson Foods*—in which a reliable methodology is applied to a different area without sufficient justification, or in an unjustified extrapolation. *Tyson Foods, Inc.*, 565 F.3d at 779-80. Other laboratories testing LCN samples modify their protocol, apply different interpretive principles to account for stochastic results, or perform replicate testing—but the NMDPS Lab applies the same protocol for non-LCN testing to LCN samples, despite recognizing that there are different problems in LCN testing and different challenges in formulating reliable interpretations. The NMDPS Lab admits that their lower limit for reliable testing is at 250 pg, but has not shown that they can properly account for the expected stochastic effects and produce a reliable conclusion for samples under 250 pg. Davis testified vaguely that the NMDPS Lab had validated its procedures for a wide range of input DNA quantities, but without explaining or elaborating; Davis did not demonstrate that the Lab had tested LCN samples and confirmed that the Lab was able to produce reliable DNA profiles from LCN samples and also to interpret them reliably. Again, Davis merely asserted that her method of interpreting was reliable, citing generally to her experience without providing evidence of reliability.

Although Rule 702 and *Daubert* set a relaxed standard for admissibility, the Government has not demonstrated that Davis's testimony on LCN testing is "scientifically valid" and "properly can be applied to the facts in issue." *Daubert*, 509 U.S. at 592-93. The Court concludes that Davis's LCN testimony is not "the product of reliable principles and methods." Rule 702(c). The LCN issue in this case does not present a "battle of the experts," in which opposing experts should be allowed to present differing, but reliable, opinions; the Court finds

that Davis's testimony on LCN is not credible and not reliable. "[N]othing in either *Daubert* or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert." *Joiner*, 522 U.S. at 146. "A court may conclude that there is simply too great an analytical gap between the data and the opinion proffered." *Id.*

The Court recognizes that, if the DNA profile for Item 1B23B were reliable, the resulting statistics regarding a match with Tracy Province would be impressive; as Krane testified, even a nine-locus match is "a very, very rare occurrence." [Tr. 5/7/13, pp. 248] But the problem is that the NMDPS Lab's profile has not first been shown to be reliable; statistics calculated on the basis of an unreliable profile cannot be reliable. [Tr. 5/7/13, pp. 264-65]

In addition, the Court is concerned that Davis did not provide a sufficient explanation for relying on the ten-second injection as what she called the "optimal" data to use for her interpretation. [Tr. 5/6/13, p. 166] This choice was important because, with the five-second injection, three additional loci dropped out. [Gov's Ex. 60a (5/6/13)] Davis would have had only seven loci to interpret instead of ten. And she would have had only three heterozygous loci on which to base an assessment of whether peak height balance demonstrated reliability. Davis did not testify about whether she could have concluded that the profile from the five-second injection was reliable.

The Court observes that Watson gave a conclusory opinion that the NMDPS Lab's result on Item 1B23B was reliable. [Tr. 5/6/13, p. 45] Watson did testify that he was somewhat familiar with the NMDPS Lab's approach to LCN, and did testify that the Lab had validated their procedure with a wide range of amounts of DNA. [Tr. 5/6/13, p. 35] But this general testimony did not show that Watson was sufficiently familiar with the facts to support an opinion on the

reliability of this specific DNA profile—particularly when he acknowledged that the quantity, 215 pg, was below their minimum for optimal results. [Tr. 5/6/13, pp. 55, 102-03, 106-07 (Watson admitting he was not entirely familiar with NMDPS Lab's procedures and interpretive principles)] Watson did not explain why a result with an input quantity below the Lab's stochastic threshold would be reliable.

The Court also observes that Defense Counsel tried to show that Davis had used the wrong stutter threshold at locus D3S1358, and should have considered the sample to be heterozygous at that locus, which would have led to exclusion of Tracy Province as the source of that sample. [See Tr. 5/7/13, pp. 220-23] The Court has cited Krane's testimony on this point, but only to illustrate how critical is Davis's conclusion that there was no drop-out at any of the five homozygous loci for which there were "called alleles" (D8S1179, D3S1358, D19S433, vWA, FGA). Krane used different software than the NMDPS Lab to generate the electropherogram in Defendant's Exhibit D10. [Tr. 5/7/13, pp. 241-45] The Court therefore does not rely on Krane's result, showing a "17, 18" for locus D3S1358 in which the peak height for "17" is above the stutter threshold and ought to be considered. (In Krane's electropherogram, the peak height of 79 is 11.09% of 712, which exceeds the stutter threshold of 10.7% for locus D3S1358.) In Davis's electropherogram for the five-second injection, both peak heights were different (69 and 681) and it was proper not to consider the peak at 69 RFUs because it was 10.1% of 681, which was below the stutter threshold of 10.7%.

Consideration of the *Daubert* factors leads the Court to conclude that the results of LCN testing by the NMDPS Lab are not reliable enough to meet the admittedly relaxed standard of *Daubert* and Rule 702. PCR/STR analysis of low-level DNA has been tested, and has been found to exhibit stochastic effects rendering the DNA profiles unreliable; indeed, the empirical

testing by the NMDPS Lab itself caused the Lab to declare testing of less than 250 pg resulted in stochastic effects. The Lab set its own threshold for reliability. It has not been demonstrated to this Court that the NMDPS Lab is able to obtain reliable DNA profiles from samples below 250 pg, or to reliably interpret such profiles. *See Daubert*, 509 U.S. at 593-94 (factors to consider include whether the theory or technique can be and has been tested). Second, peer review and publications have raised serious questions about the reliability of testing low amounts of DNA and accounting for stochastic effects. The Court has not been referred to any publications supporting the reliability of the NMDPS Lab's LCN testing. Third, the recognition of stochastic effects constitutes acknowledgment of a significant risk of error. Fourth, there are standards controlling LCN testing, to the extent that each laboratory is required to empirically establish its own stochastic threshold. Fifth, the reliability of LCN testing is not "generally accepted in the relevant scientific community." *Daubert*, 509 U.S. at 593-94.

The Court concludes that the Government has not carried its burden of demonstrating, by a preponderance of the evidence, that LCN testing by the NMDPS Lab is reliable and admissible under *Daubert* and Rule 702. The results of LCN testing will not be admitted at trial.

(2) Mixed Samples

Davis's lab reports state that there were "two or more" contributors to all of the samples she characterized as mixed samples. [Def's Ex. G6] When Defense Counsel questioned Davis on this point, Davis testified that she could not say how many contributors there were—just that there were two or more. [Tr. 5/6/13, pp. 173-78] Davis agreed that she had no way to determine the quantity of DNA from each contributor, and also apparently agreed that the quantity from a minor contributor might be below 250 pg—which would constitute LCN testing if it were a single-source sample. [Tr. 5/6/13, pp. 174-76] Davis testified, however, that the NMDPS Lab's

definition of an LCN sample simply looks to the total quantity of DNA in the sample. Davis insisted that "by definition," a mixed sample containing more than 250 pg did not constitute LCN testing even though there might be less than 250 pg from one or more of the contributors. [Tr. 5/6/13, pp. 175-76, 182] Government Counsel clearly demonstrated the Government's position that the NMDPS Lab just says what constitutes LCN testing, and anything not defined by the Lab as LCN testing deserves to be granted the same level of reliability as PCR/STR testing on greater quantities. [Tr. 5/6/13, p. 183; Doc. No. 547, p. 28 n.30 (relying on NMDPS Lab's declaration that quantities greater than 250 pg are not LCN)] Davis provided no explanation for this approach, and failed to explain why reliable results would be expected for an individual who contributed less than 250 pg to a mixed sample—when stochastic effects and unreliable results would be expected from less than 250 pg in a single-source sample.

In Exhibit 34a, submitted by the Government, an authoritative expert explained that the same concerns regarding LCN testing may apply with a mixed DNA sample even though the total DNA input exceeds the stochastic threshold:

Minor Components in Mixtures May Be Low-Level DNA

Many DNA analysts may think that low-level DNA analysis does not apply to them because they are running 28-cycle PCR and not examining DNA down at a level of 100 pg or less. However, PCR amplification involving 1 ng total DNA with a two-person mixture and a 9:1 major-to-minor component ratio leaves the minor contributor in the low template range of approximately 100 pg or 15 cells (Table 11.3). Thus minor contributor alleles in this situation could be experiencing stochastic sampling (allele drop-out, etc.) as well as allele masking by the taller major contributor alleles. This fact is important to keep in mind when working with DNA mixtures.

John M. Butler, *Advanced Topics in Forensic DNA Typing: Methodology* 334 (2011) [Gov's Exhibit 34a (5/6/13)]; *see also* P. Gill et al., *DNA Commission of the International Society of Forensic Genetics: Recommendations on the Interpretation of Mixtures*, p. 96 (same problems

with stochastic effects and interpretation may occur with mixtures as with single-source LCN samples) [Def's Ex. S7].

Watson testified that problems with LCN testing are exacerbated with mixed samples. [Tr. 5/6/13, pp. 86-87] He testified that the 250 pg stochastic threshold established by the NMDPS Lab is "the minimal amount of DNA that you can reasonably expect to produce a complete DNA profile, assuming it's a single-source sample." (Tr. 5/6/13, p. 35) Watson testified to the same principle reflected in the quotation from Butler, above; for example, Watson explained, a sample with a total input of 200 pg which is a mixture from two individuals in a 1:1 ratio represents an LCN sample with respect to both individuals, because there are only 100 pg from each. [Tr. 5/6/13, p. 43; *see id.* at 79, 104-05] Watson agreed that a problem with mixed samples is that it is difficult to tell whether some contributors are at an LCN level. [Tr. 5/6/13, pp. 86-87]

Krane also testified to the principle set forth in the Butler quotation. Even though a mixed sample contains more than 250 pg, the quantity from a minor contributor—or even a major contributor—may be below 250 pg and may constitute LCN. And "the problem just gets worse" if there are more than two contributors. [Tr. 5/7/13, pp. 227-29, 237] Krane testified that there were at least two more mixed samples with LCN issues in this case. [*Id.*]

The NMDPS Lab cannot simply define away any potential LCN issue, declaring that any sample of more than 250 pg—even if mixed—is considered to produce reliable (non-LCN) results. Davis testified that the NMDPS Lab dogmatically defines a sample as presenting no issue of unreliable LCN results—as long as the total quantity of DNA exceeds 250 pg, regardless of how many contributors there are to the sample. This is another instance of "ipse dixit" by the Government's expert, which the Court rejects. *See Joiner*, 522 U.S. at 146. The Court finds that

the quotation above from Butler, together with testimony from Watson and Krane, shows that Davis's testimony about the NMDPS Lab's approach is not scientifically reliable. When Davis cannot say how many contributors there might be in a mixed sample, even a relatively large quantity of total input DNA might be LCN with respect to one or more contributors. For example, if there were 277 pg in Item 34B, and three contributors in a 2:1:1 ratio, the sample would constitute LCN testing even with respect to the major contributor. As another example, even if—contrary to her testimony at the May 6, 2013 evidentiary hearing—Davis were to determine that there were only two contributors to Item 34B, in a 2:1 ratio, the sample would be LCN even with respect to the major contributor.

The Government presented no evidence that Butler's approach, as reflected in the quotation above, is misguided or incorrect. The NMDPS Lab cannot merely declare, without evidence or support, that a mixed sample above 250 pg does not present the problems of LCN testing. The Court is persuaded that Butler's approach is reliable and correct. Unless the Government can prove at trial, as a foundational matter, that the quantity of DNA contributed to a mixed sample by an individual exceeds 250 pg, the Government's evidence with regard to that individual will be excluded as an unreliable LCN result.

F. Rule 703

Under Rule 703, an expert may base an opinion "on facts or data in the case that the expert has been made aware of or personally observed." Fed. R. Evid. 703. "If experts in the particular field would reasonably rely on those kinds of facts or data in forming an opinion on the subject, they need not be admissible for the opinion to be admitted." *Id.* A witness qualified as a DNA expert may testify regarding data or facts on which experts in the field of DNA analysis regularly rely.

The "sufficiency of the basis of an expert's testimony is to be decided under Rule 702." Fed. R. Evid. 702 advisory committee's note to 2000 amendment. "In contrast, the 'reasonable reliance' requirement of Rule 703 is a relatively narrow inquiry." *Id.* Under Rule 703, an expert may rely on inadmissible information provided that information is "of a type reasonably relied on by other experts in the field." *Id.*

Based on the current record and the parties' arguments, the Court does not see any issues to resolve under Rule 703.

G. Rules 401, 402, and 403

Defendant makes largely cursory arguments that the Government's evidence, mostly quantitative or qualitative statistical evidence, will violate Rules 402 or 403. [Doc. No. 442, pp. 28, 102, 108-10, 116, 118-21, 133, 135]

Evidence is relevant if it has "any tendency to make a fact more or less probable than it would be without the evidence," and "the fact is of consequence in determining the action." Fed. R. Evid. 401. Although the Court cannot, at this preliminary stage of the proceedings, be fully aware of the relevance, it is apparent that the probative value of the DNA evidence is to connect Defendant, or Welch or Province, with the Haases' van and with handguns. The probative value of this evidence "cannot seriously be placed into question." *Nichols*, 169 F.3d at 1266. The DNA evidence is relevant, and admissible under Federal Rule of Evidence 402 (if otherwise admissible).

Federal Rule of Evidence 403 is rarely appropriate as a basis for pretrial exclusion. *See Paoli II*, 35 F.3d at 747. Defendant's arguments to exclude evidence under Rule 403 are fact-bound determinations "dependent upon the character of the evidence introduced at trial." Based on the current record, the Court denies Defendant's motion to exclude under Rule 403. The

probative value of the DNA evidence appears great. "The term "unfair prejudice," as to a criminal defendant, speaks to the capacity of some concededly relevant evidence to lure the factfinder into declaring guilt on a ground different from proof specific to the offense charged." *Nichols*, 169 F.3d at 1266 (quoting *Old Chief v. United States*, 519 U.S. 172, 179-81 (1997)). "Unfair prejudice' within its context means an undue tendency to suggest decision on an improper basis, commonly, though not necessarily, an emotional one." Fed. R. Evid. 403 advisory committee's note. "Unfair prejudice does not mean the damage to a defendant's case that results from the legitimate probative force of the evidence" *Bonds*, 12 F.3d at 567 (internal quotation marks omitted). The Court does not find that the probative value of the DNA evidence is substantially outweighed by "unfair prejudice, confusing the issues, misleading the jury, undue delay, wasting time, or needlessly presenting cumulative evidence." Fed. R. Evid. 403.

Regarding Defendant's arguments that various statistical calculations should be held inadmissible under Rules 401, 402, or 403, the Court observes that Defendant himself acknowledges that "statistical probabilities are basic to DNA analysis." *Davis*, 40 F.3d at 1075. The Court finds that statistical calculations accompanying DNA evidence are relevant and "of consequence," under Rules 401 and 402. Careful presentation of statistical evidence, with explanations by experts—either the Government's or Defendant's—can ensure that the jury is not misled or confused, and that there is no other type of unfair prejudice. *See* Fed. R. Evid. 403; *Chischilly*, 30 F.3d at 1158 (recognizing possibility of problems, but holding there was no Rule 403 violation in admitting statistics). To the extent that Defendant disagrees with particular statistics, he will be able to cross-examine the Government's experts and make arguments about

probability to the jury. *See Davis*, 40 F.3d at 1075. The Court concludes that the probative value of statistical evidence is not substantially outweighed by the prejudicial effect.

The Court denies all of Defendant's motions to exclude under Rules 401, 402, and 403.

H. Rule 901(b)(9)

Defendant argues that Rule 901(b)(9) requires that an adequate foundation be laid before any computer-generated DNA evidence is admitted. [Doc. No. 442, pp. 174-79] The Government asserts that Defendant's argument on Rule 901(b)(9) "is a red herring, much the same as the argument made in the motion to suppress medical investigator testimony." [Doc. No. 547, p. 53]

It is not clear to the Court, based on the current record, that the Government intends to introduce into evidence any of the computer printouts themselves. It appears that the Government intends to present conclusions by a DNA analyst about various DNA samples, but the "facts or data" on which the expert relies "need not be admissible for the opinion to be admitted" if "experts in the particular field would reasonably rely on those kinds of facts or data in forming an opinion on the subject." Fed. R. Evid. 703. The Court finds, from review of the scientific information and the caselaw, that experts in the field of DNA analysis routinely and reasonably rely on data generated by computers. Under Rule 703, these data need not be admissible into evidence for the DNA expert's opinions to be admitted. The primary issue for the Court is reliability under Rule 702.


Defendant may renew his argument at trial, if the Government seeks to admit computer-generated data.

CONCLUSION

The Court concludes that Carrie Zais Davis is qualified to testify as an expert in DNA analysis, and that the Government's DNA evidence is admissible under Rule 702 and *Daubert*—with the exception of LCN testing results, which are not admissible.

The Court concludes that the Government has not carried its burden of demonstrating, by a preponderance of the evidence, that LCN testing results are admissible under Rule 702 and *Daubert*; the Court will grant Defendant's motion to exclude the results of LCN testing. The Court thus specifically excludes the DNA evidence on Item 1B23B, conceded by the Government to be an LCN result. The Court orders the Government to lay a foundation at trial with respect to any evidence of mixed samples, demonstrating that the DNA result does not constitute LCN testing with respect to any contributor for whom the Government wants to introduce a DNA result; evidence from mixed samples which is found to constitute LCN testing will be excluded.

IT IS THEREFORE ORDERED that Defendant's *Motion To Exclude DNA and Serology Test Results and Request for Daubert Hearing*. [Doc. No. 422, filed April 22, 2012; Doc. No. 442 (Defendant's *(Corrected)* Supplemental Memorandum), filed May 10, 2012] is **DENIED IN PART** and **GRANTED IN PART** as explained above.


UNITED STATES DISTRICT JUDGE